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THE IRRIGATION AGE

CHICAGO, ILLINOIS

With Which Is Merged
**National
Land and Irrigation
Journal**

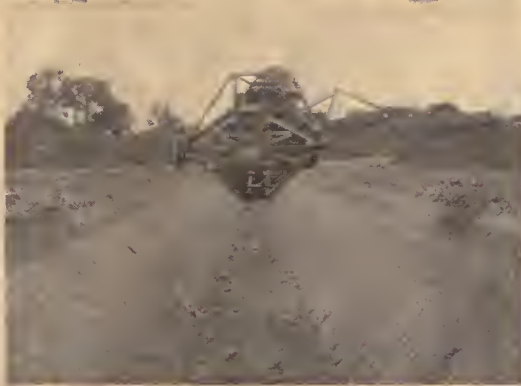
NOVEMBER, 1916

Vol. XXXII

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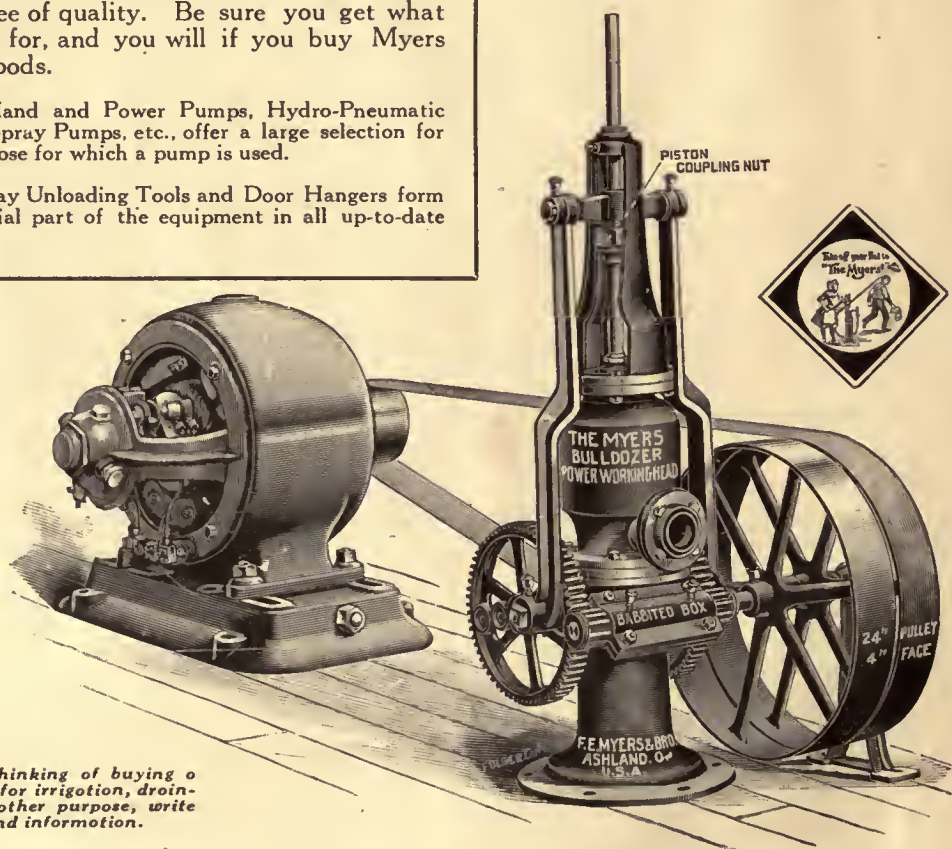
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Thirty-Second Year

THE IRRIGATION AGE

VOL. XXXII

CHICAGO, NOVEMBER, 1916.

No. 1

THE IRRIGATION AGE

With which is Merged

The National Land and Irrigation Journal

MODERN IRRIGATION

THE IRRIGATION ERA

ARIZONA

THE WATER USERS' BULLETIN

THE DRAINAGE JOURNAL

MID-WEST

THE FARM HERALD

THE IRRIGATOR

D. H. ANDERSON

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D. H. ANDERSON, Editor

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Official organ Federation of Tree Growing Clubs of America. D. H. Anderson, Secretary.

The Executive Committee of the National Federation of Water Users' Association has taken action whereby THE IRRIGATION AGE is created the official organ of this vast organization, representing 1,000,000 persons on the government irrigation projects.

The background to the recent activity at El Paso, and a feature that was at once entertaining and instructive in the highest degree, was the Soil Products Exposition, extending over a period of three weeks under the auspices of the National Dry Farming Congress.

The exhibits, comprising those of a large number of States and of the Federal Government, were worthy of the occasion and fully up to the standard of the best expositions ever held in the country. That it was fully appreciated was evidenced by the large attendance and the results otherwise to such a degree that the Farm Congress has felt justified in pledging itself to holding similar expositions annually.

The Congress itself was a success in the same pronounced measure. Addresses and subjects for discussion were of the highest order. A most interesting phase of the meeting was the decision to incorporate under the name of the International Farm Congress, and the extension of the scope of its future activities to embrace not only the annual exhibits referred to, but the subjects of Irrigation, Livestock and General Agriculture.

A full list of the papers delivered, of the speakers and of the resolutions adopted will be published in an early issue of the AGE.

There is a possibility that the next session of the International Irrigation Congress will be held in Ogden, Utah, provided the enterprising citizens of that city are prepared to give the Board of Governors of the

Congress assurance that the sum necessary to defray the expenses is forthcoming. The fact that Utah men are prominent in the affairs of the Congress will make it easier to raise the funds necessary; it is reasonably certain that Salt Lake City will not make a bid for it after the disastrous investment made by her public spirited citizens when the Congress was held there in 1912. It is doubtful if any money could be raised in Salt Lake City for this purpose without full assurance that the fact of the meeting being held in that city would help the movement to pass the Sutherland bill, which will, if it goes through, insure reasonable returns on the investment.

It is the opinion of the IRRIGATION AGE that the Congress will never regain its former standing until the necessary top expense for secretary and assistants is done away with or materially reduced.

The Board of Governors can readily change this condition by voting to pay a secretary a per diem sum for the actual time necessary to perform the work.

It will be remembered that the people of Ogden and Utah saved the Congress at the time it was

proposed to merge it with the Trans-Mississippi Congress at Colorado Springs in 1902. This movement headed by Fred J. Kiesel and others at Ogden, assisted by the people of Salt Lake and Utah generally, resulted in the best congress in the history of the organization held at Ogden in 1903.

If Ogden can do one-half as well in 1917 a rousing and well-attended meeting will ensue.

**Water Users
Study
Proposed
District Law**

Water Users generally, under Federal irrigation projects, should awake and examine the provisions of a bill approved by Congress August 11 providing for assessment of all project lands under water for maintenance and development work, regardless of whether the owners of the land are signed up for water leases or whether the lands are entered or unentered. This bill includes the displacement of Water Users' Associations and the creation of irrigation districts.

Thousands of acres of private lands on Government projects and unentered public land will be liable for a portion of the cost of development and maintenance expenses if the bill finally becomes a law.

It is claimed in favor of the bill that this proposed change would also enable project land owners to borrow money on first mortgages on their holdings.

This last feature of the bill has been exploited through these columns for many years, but no headway has been made, owing to the fact that the Reclamation officials have feared to make any move that would indicate a desire to change the Reclamation law, or cause it to be brought under the scrutiny of new members of Congress.

It is well known that Judge Will R. King, Chief Counsel of the Reclamation Service, has advocated adoption of the district plan and it is possible that this bill was presented at his suggestion.

One important point in this connection must be kept in mind by the various water users' associations, viz.: that with the passage of a district law the Reclamation Service experts will insist on a clause which will load all cost beyond the original engineers' estimates of "water rights" on the shoulders of the water users, otherwise the district plan will be sidetracked.

If some plan may be brought out where the cost "of enthusiastic dreams which have not in every instance been realized," is borne by the Government and not by the settler, then, we say, form the districts and let the Government take over as a permanent investment all reservoirs and top work, charging the settlers a stated sum for the water

which will include interest on the investment.

This plan, when properly worked out, will prove satisfactory to everyone, and it may readily be enlarged upon by the adoption of some of the ideas expressed in the article by Mr. John M. Hess entitled "Irrigation as a Means of Preparedness for Defense," which appeared in our issue of October.

**What
Ails the
Irrigation
Congress?**

The Irrigation Congress held recently at El Paso, to the long-time student and observer of events in the field with which the Congress is presumably identified, gives rise to fruitful and serious reflection. The dominant sentiment of one who witnessed the melancholy spectacle of empty benches and absent speakers, as contrasted with those former gatherings of the period prior to 1912, must inevitably be one of melancholy and of regret over the decadence of the once grand and powerful institution.

The inevitable corollary of this feeling must present itself in the query, "To what is the decline of this potential agency of helpfulness to the entire West attributable? Why has the expensive machinery of the Congress, instead of at least maintaining its former prestige, failed to vindicate itself? Were the debacle at El Paso—for such it was, in point of attendance—an isolated phenomenon, the situation could be dismissed without serious misgivings. The fact that the Congresses of 1915 and 1914 were also meagerly attended—not to speak of the failure to convene at all in 1913—points, however, to a deep-seated and fundamental defect.

The doctrine has been accepted throughout the entire civilized world that those who are charged with the immediate responsibility of success or failure of institutions, whether commercial, political or semi-public, shall be given a reasonable period in which to demonstrate their efficiency, and that those who are found wanting in the balance shall be retired. This is a wise provision, which is recognized at the annual meetings of corporate bodies, where officers must stand or fall upon the record of their achievements. In the cabinets of all enlightened governments, those whose conduct fails to justify their titles or emoluments are permitted to retire—with more or less aplomb. There can be nothing personal in the statement that five years of uninterrupted power should prove an adequate period in which to test the measure of a man's ability. The activities, the aims and ideals, everything that can be assumed to represent the constructive policies and the excuse for existence of the Congress, are centered in its permanent executive officer—its secretary. He is not one who is asked or required to do what his forerunners of conspicuous achievement

volunteered—to donate his time and energies, or even his financial support. The secretary of the Congress is not only the recipient of a liberal salary, but the beneficiary of various emoluments and privileges. He is almost unhampered in the conduct of affairs. He exercises—or would do so were he the strong character required for such an office—a free hand for the execution of anything within reason. The incumbency of such an honorable office is almost dazzling in its prospects of usefulness to the West—to the nation at large—the right man in this place could easily become a figure of national importance.

The AGE, in the past, has never permitted personal considerations to outweigh public considerations, and it conceives the present crisis in the affairs of the Congress to be of such a nature that anything less than a frank statement and review of the situation would constitute a dereliction of duty towards its readers and the public interest. The office of permanent secretary, with liberal appropriations, was created in 1909, and it has been clothed continuously since that time by one man—the present incumbent—who, however agreeable, personally, must be held responsible for the present condition of the Congress.

The inevitable conclusion of all the facts is that he, and his administration, have been weighed in the balance and found lamentably wanting. Shall his costly regime be continued indefinitely?

**Movement
Favoring
Irrigation
Monument**

The Civic department of the Salt Lake Commercial Club has started work, through its Board of Governors, on a campaign for a proposed International Monument to Irrigation, to be erected in that city.

It is the intention of the members of the Commercial Club of that city to urge the Board of Governors to make an effort to put through the Sutherland bill, which was introduced in the last Congress, for an appropriation of \$200,000 for the monument, which is to be in the form of a building that is to be used as a mecca for all irrigation interests, and be so constructed that it will accommodate public meetings of every character associated with western development.

It is the plan to raise a similar sum, making a total of \$400,000, which will cover the material and construction cost of an elaborate building. This structure is to be erected on ground donated by the City of Salt Lake or the Mormon Church at the spot where water was first diverted from a stream for irrigation purposes by the pioneers.

This movement should be heartily supported by all interested provided it is to be open without

restrictions to the water users under Federal and private projects.

The IRRIGATION AGE would not support a movement of this kind if it is to be built and maintained only as a meeting place of the International Irrigation Congress. The National Federation of Water Users must be given equal rights with every other body, otherwise a decided stand should be taken by that organization to balk the plan. The fact that there were not over 20 active water users in attendance at the International Congress held in El Paso in October would indicate that there is a lack of harmony between these two bodies, and unless the Congress is placed in charge of new men, it is doubtful if these organizations can ever be brought together for harmonious and beneficial work.

RESULT OF A SIX-YEAR TEST ON IRRIGATED CALIFORNIA LAND

More water means less instead of more alfalfa, once a certain limit has been reached.

This is the valuable lesson of a six-year field test just completed by the Irrigation Investigations of the University of California at the University farm at Davis. It was shown that, contrary to accepted belief, a limit is soon reached above which the yield of alfalfa actually decreases with increasing amounts of irrigation water applied.

In these tests, one-quarter-acre checks were used, and each test was duplicated. Quantities of water varying from 12 to 60 inches were applied to the various checks. Two checks were left unirrigated as check plats. The average yield for six years from the unirrigated checks was 4.07 tons of hay per acre.

The largest average yield, 9.28 tons, was produced by applying 36 acre-inches of water per acre, in four nine-inch irrigations.

But the most economical yield was produced with 30 acre-inches of water per acre applied in four 7½-inch irrigations, 8.99 tons of alfalfa hay being produced. The average increase in yield of .29 tons per acre by using 36 instead of 30 inches in a season was not sufficient to pay for the increased cost in water and labor. Between nothing and 30 inches, the yields increased uniformly with the increased amounts of water applied.

A slight decrease in yield was shown from four 12-inch irrigations, while a decided decrease resulted from four 15-inch irrigations, which produced but 8.20 tons of hay per acre.

At the end of the six-year test a fair stand of alfalfa still remained on all checks excepting those receiving either no irrigation, 12 inches, or 60 inches per season. In the latter, not more than thirty per cent of the original stand remained.

If you want to keep in touch with all sides of the Reclamation Problem send \$1.00 for one year's subscription to the *Irrigation Age*, 30 North Dearborn street, Chicago.

RECLAMATION SERVICE PROBLEM

Edward Gillette, Chairman Reclamation Service Board of Review, Northern Division

The purpose in establishing the Reclamation Service was and is to create irrigated farms, mainly where the works are too costly and returns too slow for private capital. On account of the upbuilding of the country generally, these improvements benefit the government to a greater extent than would be the case with a private concern. In view of the above fact, it pays the government to build many a project which would not afford a paying proposition to private capital.

The idea in this article is to some extent to deal with the settlers' or agricultural side of the problem, which has not been given necessary consideration. The foundation of the Reclamation Service was built upon the fact that the entire cost of a project would, in a given time, be returned to the government by the settlers and this money used to construct new projects on the same basis.

Impracticable and impossible conditions were and still are imposed on the settler. He is often required, without means, to make a productive farm, to provide some kind of shelter for his family, agricultural implements, work animals of some kind, money for seed, water charges and living expenses, until the soil is made to produce a crop. The government has so much money now invested in irrigation projects that Congress will soon be compelled to work the problem out in a sensible and practicable manner, based upon expert opinion and what foreign countries have demonstrated to be both practical and possible. It is safe to state that there are very few and probably not one member of Congress today sufficiently well informed to vote intelligently on the irrigation problem confronting the government. The time has arrived when more effort should be devoted to a solution of present unfortunate agricultural conditions than to the securing of more appropriations for new work, although the latter need not be neglected.

The cost of the projects as a rule has exceeded the estimates to such an extent that the settlers have become alarmed; credit at banks and stores has been refused to them on the ground that the government would attach the full expenditure to the land and that this debt would more than wipe out any equity the settler had in the land or improvements. This condition becoming acute, the settlers complained that the cost was more than it should be and that many items charged against the projects were erroneous.

After considerable discussion the Secretary of the Interior agreed that a Board of Review should be appointed for each project, whose duty should be to recommend the elimination of any unjust charges, giving the reasons therefor. The boards were to be composed of three members for each project, one to be selected from the water users by the

settlers, one by the Reclamation Service, the other to be appointed by the Secretary, and the cost of these boards to be borne by the settlers. The boards were selected last year, their reports filed with the government, but no action on them has been taken to date.

I was appointed by the Secretary as a member of the boards for the Northern Division of the Reclamation Service and by those boards elected as their chairman.

Without going into details, we found that on some projects more money had been expended by the government than the present total value of the project. This was after seven years' work by the settlers, who had expended as much in improvement on their farms as the government had in building the irrigation works, being about \$50 per acre. The settlers on an average brought a thousand dollars to the project, varying from nothing to six or seven thousand dollars; after seven years' work the average indebtedness of the settler was a thousand dollars, the tendency being toward greater indebtedness.

A most unfortunate condition developed on every project. The land became saturated with alkali water, which, evaporating on the surface, left a white covering of salts, which destroyed all vegetation. In many cases the settlers were obliged to move to other lands, losing the improvements made on their farms and start again or quit the project altogether. It was soon found that all the land under the canals would be ruined, the project be a failure and the government lose all the money it had expended, unless some remedy was devised. The digging of deep drainage ditches at intervals was the best and only solution of the problem, although the cost was from 25 to 50 per cent of the original cost of the project, besides causing much extra work to the farmer, loss of land occupied by the drainage ditch and the material excavated and short crops; in fact, it was a most discouraging condition for the settlers to encounter just as they expected to have a producing farm as a reward for all their past labor and the expenditure of all the money brought by them to the project. One can imagine that the storekeepers and banks on the project who had given these settlers credit or loans would be placed in a precarious position, even if interest rates were high, as there was little or no security for the principal.

The government and the settler are up against a hard proposition, the only difference being that the government can stand it, while the settler cannot.

The sensible thing to do is to aid and relieve the settler as much as possible, until he can get his land to producing enough to support his family and gradually pay the government the actual cost of the project. It

must be borne in mind that all expense must be paid out of what the land is made to produce; therefore it is a simple proposition that the efforts of all concerned must be devoted to making the farmer as successful as possible. Of course there are a few individual cases, where conditions were most favorable, that a settler has been able to pay the government charges, but these instances are few, as the small receipts of the government will show.

On the North Dakota Pumping Project the government has ceased to furnish water for the settlers, and their farms have gone back to the dry farming stage. The cost of this venture has been over one million dollars to the government, besides a large amount to the settlers. The government operates the power plant with a coal mine adjoining and furnishes electricity to the adjacent town of Williston. The settlers and town authorities have agreed to pay the government a sum sufficient to have the plant operated for irrigation, but without result so far. The question arises, How does the government expect to have all its expenditures returned when it abandons irrigation, causing great loss to the farmers, the value of whose farms has been depleted to one-third of the amount which the government has expended?

On the Lower Yellowstone Project in eastern Montana, an especially unfortunate condition exists. The Reclamation Service experts estimated the cost of water for the land, after several years' investigation, at not to exceed \$25 to \$30 per acre, with the probability that it would be less even than \$25. With this price distinctly expressed and understood by all parties concerned, the owners of lands in this valley agreed to mortgage their farms for the project and to reduce their holdings to one hundred and sixty acres. The cost of the project finally was double the estimate and wiped out any equity a farmer had in his own home. The widow of a farmer stated that her husband had worried himself into a decline and passed away for no other cause than that of fearing the government would enforce some of its drastic orders and practically confiscate his farm. Many other farmers were nearly as badly affected. A prosperous dry farming community was converted into a bankrupt irrigation community. The settlers refused to take water from the government as a rule, operation and maintenance charges accumulated to about \$400,000, some of the land became water-logged and alkali until finally a condition existed where better crops were raised by dry farmers above the canal than on the irrigated lands under the project. The settlers insisted, and still do, that the government make good its promise to furnish water at not to exceed \$30 per acre, which any honorable concern would be bound to do. The

Board of Review recommended strongly that the government keep its promise, act in good faith, that it was morally bound to furnish water at \$30 per acre. The settlers' faith in the government has been rudely shaken. They have been looking to Secretary Lane, as a Western man, who understands the situation, for help and justice and to insure them the ownership of their homes, but so far without result.

The stumbling block appeared to be the interpretation of the law that all expenditures must be returned to the government. How is this to be accomplished when, as is the case in the North Dakota project, the total value of all the irrigated farms is less than half the government expenditure? The farmers could lose their homes, be made bankrupt, and even then but half the cost would be returned. The idea of returning every expenditure to the government has been carried out to such an extent that items have been charged to the settlers in no way connected with their lands.

The Fort Shaw division of the Sun River project is in very bad shape, water-logged and alkali in every part; its fate is sealed unless supplied quickly with drainage ditches. A good dry farming country has been ruined by too much water and alkali.

The Huntley project in southern Montana is in fine shape, as a rule, thanks to private enterprise building a beet sugar factory near at hand. The settlers here are very prosperous and well able to return the cost of the project to the government. There is, however, 20 per cent of the land, in this project composed of a greasewood gumbo soil, incapable of producing a crop by any means so far determined. Settler after settler has gone broke in an endeavor to farm these lands. It is the duty of the government to determine some method by which crops can be raised on this soil before allowing further disastrous settlement.

On the Shoshone project in northern Wyoming the cost of water is excessive. This, coupled with expensive ditches to counteract alkali and water-logging of the land, makes it necessary that the farmer have a long time in which to make payments and other sensible help pertinent to his business. Charges such as that of the automobile road through Shoshone canyon to Yellowstone Park should be eliminated when the project had already supplied all the roads necessary for those concerned. The cost and method of payments on this project should be made fair and reasonable.

In addition to the above hard con-

ditions for the pioneer settler to overcome and get started, it must be borne in mind that he has been obliged to pay 10 and 12 per cent for most of the money borrowed. When one considers the uncertain, unbusiness-like attitude of the government, the above loans are undesirable even at the rate given, dry farm loans being better security.

The Reclamation Service is busily occupied with construction work and doing its work well, but even if it were organized for agricultural work, proper laws would have to be enacted in order to permit of any success. The question arises, Why does not the agricultural department do this work? The problem is getting to be a very serious matter as time passes; the government is making a failure of this business, which is entirely unnecessary. If it is too ignorant to devise suitable conditions itself, let it copy after foreign countries where success has been achieved by the introduction of common sense business methods. Publicity seems the only way left to start the solution of the problem involved. We cannot expect Congress to pass the necessary legislation until it has been thoroughly impressed with the conditions existing on these projects. Legislation to help the pioneer settler is the main thing to be considered.

IRRIGATION TO BE HELPED BY FARM LOAN LAW

Colorado's irrigation district problems may soon be in a fair way for a permanent solution as a result of the new farm loan law and the establishment of the twelve land banks.

The question of what will be the policy of the board in reference to these district lands has been one of the most important subjects discussed in Denver in connection with the new law. Some of those who have investigated the law say that it provides a way for taking individual farms from irrigation district mortgages so that federal bank loans may be made upon them. Some others, however, do not construe the law in that way.

"The board doesn't know exactly what will be done in regard to irrigation district lands," said Claud De Baun, representative of the treasury department. "The matter will be taken up with counsel immediately upon the return of the board to Washington. If the law does not offer any relief the board will lay the matter before the reclamation department, or congress, in an effort to work out a plan which will permit farmers whose lands are mortgaged for irrigation bonds to receive some profit from the law.

"The object of the law is to help the farmer. At the same time it is essential that the security of the bondholders shall be maintained and it will be necessary for them to have first mortgages on land which is worth twice the amount of the loan."

Frank N. Briggs, president of the Interstate Trust Company, takes the position that the law provides a way for the irrigation districts to come under its benefits by depositing the bonds of the district

with a trustee so as to permit the farm loan mortgage to come under the irrigation district mortgage.

Members of the board said today that they would like to hear more on this subject because it is their intention to look into it thoroughly in an effort to find a way for helping the Western states. The question already has been brought to the attention of the board several times, it was stated.

Colorado has some of its most valuable lands tied up in irrigation districts, where the irrigation companies have gone on the financial shoals and left a cloud upon the title to the land or water rights. Some method of straightening out these difficulties and enabling the farmers to establish themselves on a firmer foundation may be one of the direct effects of the establishment of a land bank in this district.

SEEK TO CONTROL COLORADO RIVER

R. M. Priest, an engineer of the Reclamation Service, and a corps of assistants, are investigating the tributaries of the Grand river and seeking reservoir sites by which the flood waters of the Colorado river may be controlled.

It is proposed to stop the annual rampage of the river, which causes thousands of dollars in damage by storing the flood waters in immense reservoirs, which also will be released as needed for irrigation. This will mean the trebling of the irrigated area of the Colorado river basin.

Another party will survey the drainage area of the Green river and select suitable reservoir sites.

RESOLUTIONS

Twenty-third International Irrigation Congress Held at El Paso, Texas

The International Irrigation Congress, at the close of its first quarter century of existence, tenders its profound gratitude to the American people for the generous measure of recognition accorded to its cause, and to the people and governments of many foreign countries, particularly the Dominion of Canada and the Commonwealth of Australia, for their sympathy, co-operation and support.

We view with inexpressible pride and satisfaction the long road of constructive progress over which the nation and the world have advanced during the past twenty-five years toward higher ideals of human welfare and brotherhood; and in this time, which sees many of the greatest forces in the world engaged in strife, we would lift higher than ever the banner of the great pioneer movement which wages war only upon the destructive forces of nature, which aims only at the subjugation of the desert places, which seeks no trophies save reclaimed valleys and happy homes.

Since the beginning of this movement in 1891, public opinion concerning the arid regions of the earth, and particularly those of western America, has been completely revolutionized. Irrigation has become a science, and it is recognized that by means of its ministrations aridity itself is but another name for the highest degree of fertility. The recognition of these facts was equivalent to the discovery of a new continent, for vast areas formerly regarded as almost worthless were thereby opened to development and occupation.

As the swift consequence of this fundamental change in public opinion the National Reclamation Act was placed upon our statute books in 1902, marking the first step in a new and beneficent public policy, and this was followed by the Forest Reserve Law, which dedicated the source watersheds to the service of the people in perpetuity. Later legislation extends to state irrigation districts the right to include unentered government land, imposing thereon proportionate project charges the same as on lands privately owned, while the Federal Farm Loan Act extends credit to our farming population on an equal footing with the more favored occupations.

In spite of what has been accomplished, however, this Congress keenly realizes that its work is only begun, that it has scarcely approached the human problem—the problem of making it possible for millions to get ready access to the soil, building prosperous homes and organizing all the institutions of civilized life—the solution of which is the end and aim of all our efforts. On the contrary, we recognize that the influence which this body has exerted during the past quarter of a century must be continuously maintained, since the evolution of new and better forms of life upon the land must proceed with the growth of the race.

The Endowment Fund

As one means of perpetuating the influence of this movement throughout all coming generations, we heartily endorse the plan of the Board of Governors which look to the raising of a large endowment fund by means of voluntary contributions on the part of the friends and beneficiaries of the cause, such fund to be invested so that it shall yield an income sufficient to meet the annual expense of the Congress, and we rejoice in the fact that the nucleus of this endowment has already been paid in and deposited in trust for this great purpose.

World Irrigation Center

As a second means of perpetuating the movement and vastly increasing its facilities of usefulness, we approve the project for the erection of a public building at Salt Lake City, Utah, the cradle of American irrigation and birthplace of the Irrigation Congress, and we learn with great satisfaction that the people of Utah stand ready to donate a magnificent site overlooking the mountain stream first turned upon the desert by the hands of English-speaking man. We express our appreciation of the action of Senator Sutherland of Utah in introducing Senate Bill 4828, providing for an initial appropriation for a building "suitable for the establishment and maintenance of permanent exhibits, illustrating works of irrigation and methods of applying water to the soil, a library of irrigation, including its relation to agriculture, engineering and colonization, and for the use of meetings and conventions held for the promotion and advancement of irrigation and reclamation of arid lands, and for such other related purposes as may be determined by the commission to be placed in charge."

We pledge our earnest efforts in support of this measure and invite the co-operation of the several states and of foreign countries interested in the work, to the end that there shall be created during the next few years a world center of irrigation thought, knowledge, practice and history which shall possess all the essential qualities of a great university of irrigation, as a practical means of working out future public policies, to be placed at the service of mankind.

Financing Future Work

While the nation has already supplied \$120,000,000, drawn from the proceeds of public land sales, for our various irrigation projects, the work which must go forward for generations has only begun and vast sums of money will be required to enable us to take full advantage of the nation's opportunity. Fortunately, the need can be met without taking money from the treasury and without the issue of bonds, since the opulent resources of western America are adequate in themselves to this situation, at least for many years to come.

Within the forest reserves of the Pacific Coast states, outside of Alaska, we have approximately fifty million acres of timber land, on this

area are billions of feet of ripe timber, timber that is ready for the saws and that should be manufactured into home-building and farm-serving material. The irrigation projects of the future must look to these forest reserves for their water supply, and within the reserves the storage reservoirs will have to be constructed and maintained. The forest reserves are for service; the ripe timber product within them, placed in the market upon reasonable terms, will provide a fund that will readily install every storage reservoir or system necessary for the harnessing of these waters to service on the arid lands.

This ripe product cannot better serve than to be made to furnish these storage reservoirs and systems without cost to the lands to be served and without burden to the men and women who are to keep these waters and lands in service union. When so constructed, the reservoirs and systems should become and remain a part of the forest reserves and be so maintained, and will thus render their highest service if their delivery is limited to irrigation districts or other state units, thereby placing the distribution of the waters in service in the hands of the state authorities, providing, however, that there be delivered by such state units no water for irrigation exceeding a reasonably sized farm unit to any one person or corporation.

We, therefore, recommend that immediate steps be taken by the Federal Government to place the ripe timber within the reserves in the market for manufacture, to the end that it may be made to render the highest service to the people.

The Reclamation Service

The Irrigation Congress can with just pride of achievement point to the results secured under the operation of the Federal Reclamation Law enacted June 17, 1902. The Reclamation Service is now, after only fourteen years' existence, prepared to deliver water to one million six hundred and eighty thousand acres of land. There were actually irrigated during the present year nine hundred and forty-six thousand acres, which produced crops valued at twenty-two million dollars. Approximately one hundred and twenty million dollars have been expended in the construction of irrigation systems.

Our country cannot afford to discontinue or handicap the work of the Reclamation Service, which has added greatly to the agricultural development and provided farm homes for thousands of citizens, but, on the other hand, should give it the most generous support.

It is needless to state that in the carrying out of this tremendous undertaking mistakes have been made, or that enthusiastic dreams have not in every instance been fully realized; but in comparison with the vast achievements any errors of judgment sink into insignificance.

We do not believe, however, that

the settler who is struggling to make a home upon a land should be called upon to bear the entire burden of such disappointments. On the contrary, we believe that this situation should be met by the Government in a spirit of the broadest fairness and justice; that legislation should be enacted looking to a proper reduction to the land owners in the cost of construction where such cost is excessive as reported by the Board of Cost Review.

As one means of effecting the desired end, we recommend that legislation be enacted to authorize administrative officials to charge off of the construction cost such main works and structures, including dams, levees and other works primarily designed or serving as useful adjuncts to flood control, and therefore properly to be retained under permanent government charge and jurisdiction, or the extension of payments for such works over a long term of years without interest. We believe the reclamation fund should be reimbursed for

States, and providing proper safeguards for the United States upon its guarantee.

Underground Waters

Since there are millions of acres of valuable land which can only be reclaimed by means of pumping water for irrigation, a phase of the industry which has not as yet received any encouragement by the government, and since it seems only just that the policy of storage and distribution of water should be supplemented by adequate development of underground supplies, we recommend that the president of this Congress appoint one man from each arid and semi-arid state in the West for the purpose of a conference looking to united action in obtaining federal aid for this purpose.

Interstate Streams

Important and troublesome problems have arisen involving the use of waters from interstate streams or the use of waters from interstate streams in states outside of the state whence flows the supply. We recommend

of the people of Arizona, Washington and Montana to the singular fact that they have thus far failed to enact any state water code at all.

Diversion of Flood Waters

The investigation of the Mississippi River Commission having shown that the top one-third of the floods on that stream are the source of the greatest damage by such floods, and that this flood water comes from the western tributaries of the Mississippi; and experiments extending over a period of eight years having demonstrated that there are large areas of semi-arid land in the states of North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Arkansas and Texas which can successfully grow crops with a single irrigation during flood season, we would urge that the Congress of the United States should provide for the diversion of these flood waters on the semi-arid lands, at least to the extent to which such diversion will decrease the expenditures necessary for flood protection on the lower Mississippi River.



Diversified Farming in Colorado

the cost of such works by direct appropriation, as is done in the case of all other public works, and we would also earnestly suggest the elimination of general overhead charges involved in reclamation work from the price which settlers pay for water.

Irrigation Districts

This Congress endorses the general principles and objects of legislation having for its purpose the reclamation of arid, semi-arid, swamp and overflow lands through direct organizations, and providing federal aid therefor through guarantee of interest upon district bonds by the United

States, and providing proper safeguards for the United States upon its guarantee.

Uniform State Laws

It is essential in the working out of a general system for efficient water service, particularly in view of federal interest therein, that our state irrigation district laws and water commission acts shall be made as nearly uniform as their diverse situations may permit. We, therefore, recommend that the various irrigation states inaugurate at once a co-operative plan for the codification of their water laws, and we call the attention

Eastern Forest Reserves

We recommend that the Congress of the United States continue the policy expressed in existing federal laws towards the acquisition and establishment of forest reserves within the Eastern States, and support it with adequate appropriations.

Duty of Water

We recommend that the Department of Agriculture, the state universities in the irrigated area of the United States and the governmental agencies in the countries represented by this Congress inaugurate a com-

(Continued on page 205)

SIMPLE SIDEWALK CONSTRUCTION FOR THE FARM

The following is a true description of the situation to be found on many prosperous farms: "A comfortable and well-built house, tastefully furnished. A wide porch affording protection from sun and rain. Substantial barn and outbuildings. Between these buildings run the pathways or walks used many times each day, but on hundreds of farms they are simply thoroughfares of mud during frequent periods but especially in the spring, when the frost is coming. They are a false and discordant note in an otherwise attractive environment."

Now, the farmer who fails to establish good walks about his premises can no longer plead prohibitive cost or lack of time, and this is the season for him to remedy the situation. It is the purpose to set forth briefly a method of doing this at minimum outlay and by means so easy that it will seem like play to have a substantial walk from building to building, or from house to the garden—some-



View of a Two by Three Feet Concrete Slab Suitable for Farm Walks.

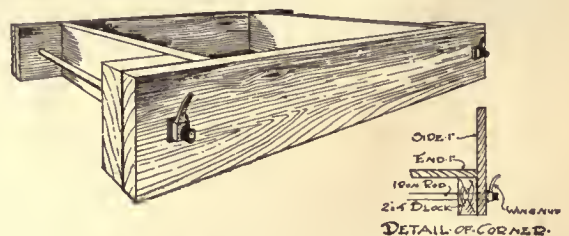
thing an intelligent boy of mechanical bent could accomplish.

To put down a concrete walk such as is common in towns and cities, involves more or less experience and requires time and money, though it would be a good investment if well done. Such walks are far cheaper in the end than any other continuous type equally satisfactory and durable. It so happens, however, that many farmers cannot conveniently undertake the construction of a long walk with the certainty that work will not be interrupted, and walks of this character should be a continuous operation if the most economical results are to be obtained. If the farmer can afford to employ an experienced contractor to do the work, well and good. If not, he should go about it in another way.

Some years ago a firm of enterprising young men engaged in general contracting in a Pennsylvania town of three or four thousand inhabitants. They noticed that all the little-used streets had board sidewalks. These were constantly rotting away or the ends of the boards would become loose and dangerous, warping with exposure and presenting an obstruction to pedestrians. Numerous complaints and frequent threats of suits for damages were filed with Town Council at each meeting

of that august body. Noting this the young contractors decided that a good opening for increased business was at hand. They did not interfere with the professional sidewalk makers. They simply began the manufacture of concrete slabs and made it a profitable business. A farmer can follow the same plan. The method would be to make a few shallow boxes, each about 3 feet long, 2 feet wide and 4 or 5 inches deep. Then make a concrete composed of 1 part Portland cement, 2 parts clean sand and 4 parts gravel or crushed stone, the stone not larger than $\frac{3}{4}$ inch. To make the concrete, first thoroughly mix the cement and sand in the dry state and then add the water. The stone should also be wet and the whole mass mixed together until of mushy consistency, a consistency that would be called "sloppy." Dump the concrete into the boxes to the depth and an inch or more, puddle and work it, and then on top of this first layer of concrete place common chicken wire cut to the size of the box. Then fill the box with concrete and just before the latter had taken its final set the surface may be broomed with a circular sweeping motion to give a texture that will prevent people from slipping. The concrete may be removed from the forms or boxes in 4 or 5 days and protected from sun, wind and freezing, as the case may be, and thereafter sprinkled daily for about a week. The result will be a fine slab of indestructible, artificial stone.

Modern sidewalk practice does not always include a drained subbase, as many suppose, but on the contrary many sidewalks put down in the customary way have been successfully built by placing them directly on a compact earth surface. The farmer can lay slabs on a natural base where the soil is at all suitable. This plan means that he may make just as few or as many slabs as he has time to make, once he has procured the raw materials. He could soon fill a half-dozen 3-foot molds and thus have 18 feet of walk in the forms, which could be refilled the moment the first lot was removed, or at any convenient time. In brief, he would be making so much concrete lumber, which could be distributed quickly and easily, in fact in less time than would be required to put down a well-made boardwalk.



A Simple and Convenient Board Form or Box for Casting Slabs.

In making his walks, the farmer need not confine the dimensions of the slab to those given above. If he prefers a longer and wider slab, it can easily be made. The first illustration shows the surface texture of a concrete slab of the above dimensions and the second is a drawing of a simple type of form in which slabs may be conveniently cast.

Concrete walks of this character would not only last for all time, but could be conveniently moved.

FUTURE WATER CONSERVATION IN SOUTHERN CALIFORNIA

In the Los Angeles Times of recent date, Harry Bowling, one of the best informed irrigation men of the west, reviews in detail the irrigation possibilities of Southern California.

"Southern California," he writes, "when all the waters are properly conserved, will witness a startling change in its topography—like the change in road travel when an old, dusty lane is broadened, leveled and macadamized. Water conservation means that our rivers and creeks will be made over in the scientific and thorough way that installed the good roads system throughout Los Angeles county. And the transformation of the country will be even more remarkable.

"From San Gabriel Canyon to Alamitos Bay as the crow flies is less than fifty miles. But in crossing this strip of territory the San Gabriel twists and wriggles till it manages to scoop out a water course more than a hundred miles long. In many places its bed is a mile across, though the actual water channel or channels occupy only a twentieth of the space. During the rainy season it has eaten through acres of good farm land and wasted tons of good real estate on the inappreciated waters of the Pacific Ocean.

"To undertake the straightening of this river seems a big job, but it is insignificant compared with the gigantic task of bringing the Owens River water from the base of Mt. Whitney into the city of Los Angeles. Yet this was successfully accomplished without government aid. We hope and believe, however, that the United States government will lend a hand in helping to conserve the storm waters in Southern California, for which work plans are already being formulated.

"Supposing the cost of reconstructing the San Gabriel River to be \$8,000,000. This would be a cheap price compared with the benefits that would accrue from new orchards, new alfalfa and sugar beet fields, new dairies and stock farms in a hundred different localities. As soon as the extra water was available for irrigating interest would be forthcoming on the capital expended, and with prudent management ten years should see the debt wiped out. When you come to think that every acre brought under irrigation is enhanced ten times in value, the cost of saving all our winter rains for agricultural purposes looks like a conservative and paying investment, however large the initial outlay. On the credit side we must also add the sum saved every winter from flood damage, washed out bridges, filled-in harbors and good soil pounded into sand by unfettered flood waters.

"In the Salt River Valley, Arizona, the United States government has carried out a more difficult project by building the Roosevelt Dam, providing water for 210,000 acres, at a cost of \$11,000,000, and the revenue for 1915, exclusive of land sales, is calculated at \$500,000. Land that formerly was worthless is now selling at \$300 an acre. Before the time granted by the government for refunding the money has elapsed, the capital and interest will have been fully paid up and the whole project belong to the farmers of Salt River Valley.

"After the San Gabriel the Los Angeles River is the chief water course in the county. This, too, has been neglected in the past. As this stream empties into San Pedro harbor and causes incessant expense to the government for dredging operations, the government is also interested in controlling and regulating it.

"There are three schemes now being worked out for water conservation in Southern California. One is to divert the Los Angeles River from the San Pedro harbor into the marshes that line the coast from Bay City to Balboa. Another is to control all the water courses by building an immense dam in the foothills to impound the storm waters in one gigantic lake at the base of the mountains. This lake can then be tapped for irrigating thousands of acres between San Bernardino and Santa Monica. A third plan is to straighten the principal streams, catch the overflow in various reservoirs along the course, and dispose of the silt in convenient places. A combination of the chief features of all three schemes may be the final outcome."

ENGLISHMEN PRESENT BIG CLAIM

There is a pretty international tangle developing around the Elephant Butte government project in Texas and New Mexico.

Nathan Boyd, of Las Cruces, N. M., organized the Elephant Butte Dam and Irrigation Company years ago and interested a vast amount of English capital.

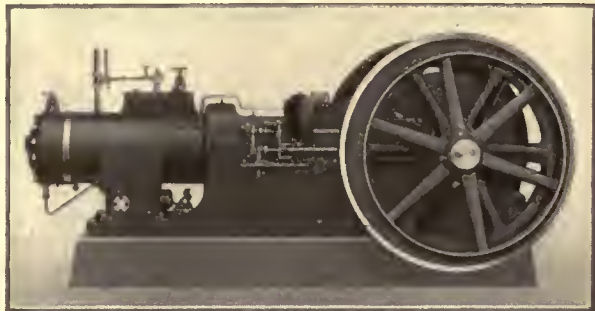
Boyd attempted to build a dam at Elephant Butte for the reclamation of the Mesilla valley, but the United States government beat him out on it in the courts after long and costly litigation on the plea that a dam at the Elephant Butte would interfere with the navigability of the Rio Grande. Then the U. S. Reclamation Service turned around and built the dam, on the plea that under treaty rights the government owed Mexico and Texas a certain amount of the waters of the Rio Grande.

Now Nathan Boyd's associates have turned to the state department with a nice sized claim for damages. New Mexicans fear the Reclamation Service will use this claim as a pretext to give away some more of the waters of the river.

F. E. Myers & Bro., Ashland, Ohio, have recently published a poster patterned after their annual calendar poster which shows their line of power pumps only. This poster is an exceptionally good example of the Lithographers' art. It shows only a few illustrations of their line of Bulldozer Power Pumps and working Heads. These pumps are particularly adapted to irrigation and heavy drainage work and a copy of this attractive poster will be mailed to any of our readers who will write F. E. Myers & Bro., Ashland, Ohio, and mention IRRIGATION AGE.

**SEND \$1.00 FOR THE IRRIGATION AGE
ONE YEAR AND THE PRIMER OF
IRRIGATION.**

LOOMIS OIL ENGINES



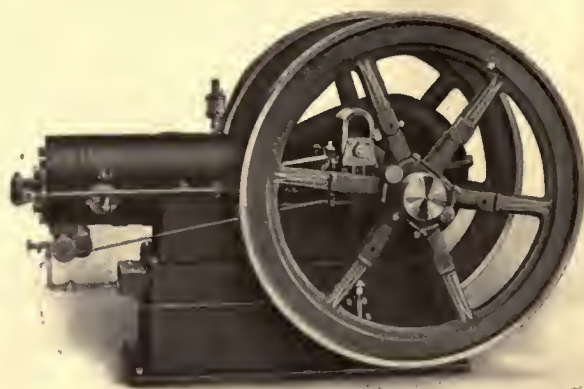
USE THE CHEAPEST GRADES of FUEL OIL

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Being of the throttling governor type they regulate as closely as any ordinary steam engine and give a steady, smooth power.

Built in sizes from 2½ H.P. to 100 H.P. in the Portable, Semi-portable or stationary types. Write for Special Bulletin and Dealers' prices.

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NEWS NOTES FROM IRRIGATION PROJECTS OF THE COUNTRY

California

Eighty thousand acres of land will be supplied with water when the Yosemite Water Supply Company of Alpaugh completes its system. The land to be reclaimed lies in the Alpaugh district, and water is being piped to the land and will be under 50 pounds pressure. The supply is obtained from artesian wells. When the piping is completed, the land embraced by the company's irrigation scheme will be subdivided.

Messrs. Lutze, Holl and Bottger of Orland have purchased 42 acres of land on the Murdock tract near that city and will develop the property. A well will be sunk, a reservoir built and a private irrigation system installed. They intend to specialize in peas, tomatoes and onions and will devote a portion of the land to berries.

The Farm Land and Investment Company of San Francisco has applied to the State Water Commissioner to obtain rights to 100 cubic feet per second of water from the Yuba and Feather rivers in Yuba county for the purpose of developing rice lands. The company has 14,000 acres to be brought under cultivation.

The Paradise Irrigation District of

Paradise, Butte county, has applied for 19,600 acre feet of water to be obtained through the storage of flood waters of Butte creek. The plans include the building of a storage and diversion dam. The cost of the project is estimated at \$350,000.

E. W. Pereira of Ft. Jones has made application for the appropriation of 125 cubic feet per second of the water from Scott river. Mr. Pereira proposes bringing 10,000 acres under the ditch.

Engineers Hawley, Whitney and Loveland, employed by the State of California, have recently reported on an irrigation scheme which if carried to completion will save practically the entire output of Putah creek, now running waste, and result in the fertilization of 55,000 acres of valley land in northern California. Three suitable sites for reservoirs have been discovered. The main sites, Devils Gate and Guenoc, would cost \$700,000 and \$500,000, respectively, or if built jointly, \$1,100,000. The Guenoc dam alone, if constructed to a height of 100 feet, would flood 5,500 acres of valley land. The report shows that the expenses of such improvements would be about \$35 per acre to the land receiving the benefits. The financing of the scheme, if approved

by the State Bonding Commission, will provide for no payment on the cost of the work for twenty years, after which the acre cost would be from \$4.10 to \$5.30.

Idaho

Secretary G. A. Remington of the Nampa and Meridian irrigation districts has given out the maintenance assessment as fixed by the board of directors for the current year. The maintenance levy on acreage tracts is fixed at \$1.05 per miner's inch, the equivalent of \$0.656 per acre. For bond interest the district will collect \$1.296 per miner's inch, or \$0.81 per acre. On lots in Meridian the maintenance charge will be 14 cents, with 16 cents additional for interest expense. In Nampa no maintenance charge is collected. The bond levy amounts to 35 cents per lot.

Plans for an irrigation project lying between Caldwell and Notus are at the stage now when construction activities may soon be started. An area of 5,000 acres can be served under the system, the engineers estimate. Three thousand feet of steel pipe will be used in siphoning water across the Boise river for distribution over this tract. Under the water right filing made by H. A. Griffiths last spring, (Continued on page 206)

(Continued from page 201)
prehensive and sustained study of soil requirements in moisture necessary to maintain the highest production of the soils in these areas, for the purpose of establishing the highest duty of water as well as the prevention of injury to the land.

Stream Measurements

We recommend adequate appropriation by the United States of funds to enable the Geological Survey to continue and complete, in conjunction with state agencies, investigations of stream systems and water supply.

Land Settlement

Experience has demonstrated that some system must be devised to aid the man of moderate means in establishing himself upon the land. For lack of such assistance, success of the new settler on irrigation projects has been the exception and failure the general result. To remedy this condition some centralized public authority must aid the settler in doing the things which necessarily precede his entrance upon the productive cultivation of the land. We earnestly urge that the following features should be incorporated in public controlling development:

1. That the execution of all developments be under co-operative agreements between the Federal and State authorities, the former to plan, construct and operate the works until paid for, the latter to undertake the settlement of the land and give financial aid and practical direction to settlers in making the land habitable and productive. Both authorities have a vital interest in the outcome, and

each is especially suited to carry out the part indicated.

2. That each development follow a definite and comprehensive plan, carefully worked out in advance, in which each unit will constitute a distinct and self-contained entity, with adequate water supply, well-balanced agricultural and grazing areas, carefully located townsites and suitable public facilities.

3. That there be segregated with each irrigable area a certain area of public grazing land, satisfactory in character and adjacent to the irrigable portion if possible. That the grazing area allotted each settler be sufficient to insure pasturage for a reasonable number of live stock. Its title should remain with the government and be used under regulations which will secure the highest beneficial use. The proportion of grazing to irrigable land should be determined by careful study, but is believed to approximate ten to one.

We express the sincere interest of this Congress in pending legislation which looks to the preparation of ready-made farms on the public domain, with advances to settlers and provision for acquisition of land either under perpetual leasehold or freehold, at the option of the settler.

In considering the subject of land settlement, it should always be remembered that energies, either of mankind or of the physical world, are destructive if not properly directed, constructive and man-serving if properly availed of. In Europe today human energy is being expended on battlefields. Here energy is being expended in building farms for Ameri-

can farmers. It is clearly our duty to provide ways and means to help the largest possible number to get homes on the land.

Water Resources of the World

Since the systematic organization of all fresh water resources for the purpose of irrigation, flood prevention and control, drainage and navigation is of supreme importance, we gladly accept the urgent suggestion of the Hon. Niel Nielsen, representative of New South Wales in this Congress, and pledge our energies to the inauguration of a world-wide propaganda to secure the co-operation of various national and state governments and their people to these ends:

1. In securing as early as possible a complete and detailed survey of the whole of such resources.

2. In co-ordinating the existing national and state laws relating to water.

3. In passing the necessary additional legislation to bring into existence the proposed system of organization and for the financing of such system, whereby the nation and the states concerned may jointly provide the funds requisite.

4. The preparation and adoption, after complete data have been collected, of a definite and complete series of plans covering each water system concerned and the gradual carrying into effect of such plans until the whole of the water resources of the country are utilized in the most effective and efficient manner for the benefit of the nation.

(Continued on page 206)

Dredging Equipment Dealers and Manufacturers, Contractors for Dredging Projects, Etc.

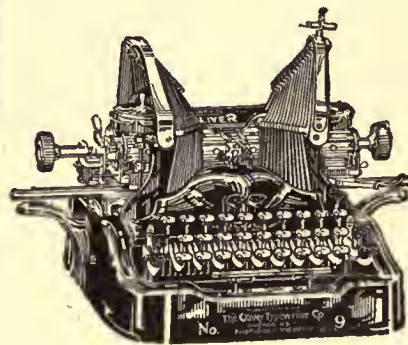
We can place you in touch with new **irrigation, drainage and dredging** projects of all kinds **long before reported in any trade publication** or known to the trade world. **We have special facilities for getting this information in advance.** The price of our service is comparatively nominal.

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To the People of El Paso

To the people of El Paso, the members of the Twenty-third International Irrigation Congress, in parting, desire to say:

There are no words in which it is possible for us adequately to thank you for your sustained loyalty to the irrigation cause through all the years of the past, and especially for the treatment bestowed upon us on the present occasion. We have heard of southern hospitality and of western hospitality; both are famous throughout the world. During the past few days we have been the happy recipients of both these famous brands, so blended and administered that we can imagine nothing to surpass them. You have anticipated our every want and provided us with every comfort and convenience. While there are individuals who might be mentioned because of their tireless activity and extraordinary generosity in our behalf, we feel that our thanks are due to all El Paso in general, and they are so expressed. We must, however, acknowledge our indebtedness to the *El Paso Times*, *El Paso Herald* and the Associated Press.

The difference between the El Paso of 1904 which we beheld on our former visit and the El Paso of 1916 as we see it now is the difference between a flourishing country town and a metropolis whose future greatness is assured. We congratulate you alike upon your achievement and your promise. As you are rightfully proud of the one, so you will be royally equal to the other.

Again we thank you from our hearts and assure you that we share both your pride in the past and your confidence in the future. And as a memento of our faith and our love we leave you the mighty dam at Elephant Butte.

Here's Something New about California For You

Two parties of Eastern farmers saw California under my personal escort last fall.

It was not a land-selling trip—it was solely for investigation.

We were guests of over forty local communities. Their Chambers of Commerce and Boards of Trade provided the automobiles and guides who showed us the agricultural activities in their neighborhoods.

We saw irrigated fruit farms. We saw alfalfa making large yields under irrigation. We saw diversified farming with its sure returns paying still better because of irrigation.

A Book of Pictures

taken on this trip is now ready for free distribution. We would like to send you a copy.

You can prolong your active business life at least fifteen years in California. It is a country where you can farm twelve months in the year. You need not spend a large share of your earnings just to keep warm.

Write me today. Let me help you plan your trip. Reduced fares next Spring and Summer will give you a chance to see the San Diego Exposition and agricultural sections of California at small cost. Winter tourist fares now in effect. Ask all the questions you want and say "Send Farmers' Special Book."

C. L. SEAGRAVES, Gen. Colonization Agt.
Atchison, Topeka & Santa Fe Ry. Co.
2284 Railway Exchange, Chicago.

(Continued from page 204)

the necessary water is to be taken from one of the big drainage ditches east of Caldwell. The water will be carried around the city of Caldwell to the northeast, over Canyon hill to the Boise river in an open canal. Conveyed across the river in the pipe line, the main canal will carry water over the bench lands between Caldwell and Notus by gravity, no pumping at any point being necessary.

Montana

Contract has been awarded under authority of the Secretary of the Interior to Booth & Knipe of Saco, Mont., for the erection of structures on laterals and waste water ditches of the Nelson reservoir, South Canal, Milk River project, Montana, at a total price of \$28,384.50. The work involves about 10,000 cubic yards of excavation, 600 cubic yards of reinforced concrete, 1,300 square yards

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FREE—A copy of "Boyd's Farmers' Alfalfa Guide," price 10c, will be mailed free to any reader of Irrigation Age who will write for the book and mention Irrigation Age.

of paving and the placing of 40,000 pounds of reinforced steel and 134,000 feet B. M. of lumber. The work is located in the vicinity of Saco and Beaverton, on the Great Northern Railway.

An issue of \$50,000 of Yellowstone municipal irrigation district bonds of Rosebud county, Montana, is offered by the Spokane & Eastern Trust Co. They are 6 per cent coupon bonds in denominations of \$500 and \$1,000. The price at which they are offered is \$101.47 and accrued interest. They are to net 5½ per cent from date of purchase to January 1, 1920, and 6 per cent from January 1, 1920, to date of payment. The total bonded debt of the district is \$250,000, which was used in buying and constructing canals and improving the system. The district comprises 9,996 acres and lies between the towns of Howard, Finch and Sanders, along the line of the Northern Pacific.

Mr. Frank Strouf of Denton has purchased a 2,000-acre irrigated tract in Teton county near the town of Bynum. It is understood that the

purchase price, \$75,000, included live stock, improvements and equipment.

Oregon

The Middle Fork Irrigating Company, which operates over 50 miles of ditch in the Upper Hood River valley, has elected the following officers for the ensuing year: C. E. McIntosh, J. R. Barroll, W. L. Mason, M. O. Boe and C. T. Rawson. The report of the secretary showed that the company had operated during the past season at a substantial profit. The irrigating ditches of the company run practically through level land, and operating and maintenance costs have been reduced to a minimum.

Engineer Rea, who is in charge of the Ochoco irrigation project near Prineville, Crook county, has submitted a report to State Engineer Lewis which is looked upon as favorable to the reclamation of 23,000 acres of land. It is proposed to issue bonds for \$1,000,000 in order to finance it. The plans include the construction of a dam 125 feet high, providing for the storage of 47,000 acre feet of water, also for the construction of a power plant of 800

horsepower to pump water to the higher lands. Most of the land can be reached by the gravity system.

Texas

The Federal Court has ordered a foreclosure sale of the properties of the San Benito Land & Irrigation Company to satisfy bonds aggregating \$1,050,000.

The reorganization of the Texas Land & Development Company assures, according to announcement, the completion of the gigantic irrigation project near Plainview, which has been in a state of inaction for several years, as far as new development is concerned. The company owns 60,000 acres of land susceptible to irrigation by pumping, and has already put down 60 wells, installing an individual pumping plant in each, capable of irrigating 120 to 160 acres each. Under the new organization many new wells are to be put down and irrigation machinery installed until the entire tract is reclaimed. C. J. Hubbard of Boston has been elected president of the company, succeeding H. I. Miller of New York, resigned.

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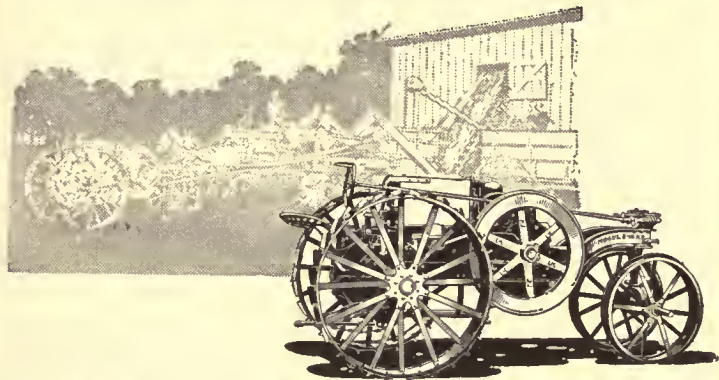
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Thirty-Second Year

THE IRRIGATION AGE

VOL. XXXII

CHICAGO, DECEMBER, 1916.

No. 2

THE IRRIGATION AGE

With which is Merged

The National Land and Irrigation Journal

MODERN IRRIGATION

THE IRRIGATION ERA

ARID AMERICA

THE WATER USERS' BULLETIN

THE DRAINAGE JOURNAL

MID-WEST

THE FARM HERALD

THE IRRIGATOR

D. H. ANDERSON

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D. H. ANDERSON, Editor

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Official organ Federation of Tree Growing Clubs of America. D. H. Anderson, Secretary.

The Executive Committee of the National Federation of Water Users' Association has taken action whereby THE IRRIGATION AGE is created the official organ of this vast organization, representing 1,000,000 persons on the government irrigation projects.

King Graves Report Delayed

Owing to the fact that a transcript of Judge Will R. King's part in the debate at the International Irrigation Congress recently held at El Paso has not been furnished us by Judge King, it will be impossible to publish the first paper covering same until our issue of January.

Judge King wires the AGE that stenographic copy will reach us in time for that issue.

What Drainage Will Do

Potatoes from the San Luis Valley, Colorado, are being received in car-load lots in the larger markets of the central states, and are selling for \$2.10 a bushel in car lots. These potatoes are said to be unusually fine and this brings to mind the fact that hundreds of people in the middle west invested in San Luis lands a number of years ago and on settling there, found the land very fine and water for irrigation in abundance.

Owing to a lack of experience in irrigation farming, a large part of this land was overirrigated, thereby bringing the water table so near the surface that crops were ruined and large numbers of the investors returned to their former homes with a poor opinion of farming under irrigation.

Subsequently those who remained studied the problem of drainage and this remedy was applied,

with the result that within the last two years a great change has taken place and wonderful results in the way of crops have been obtained; this is particularly true of the potato crop, and in many instances the yield has been in excess of 200 bushels an acre. Thus it will be seen that the investors who remained on their holdings and worked out the problem of drainage are being well repaid for their years of hard work.

This, it appears to us, is a great lesson to those who, like the early settlers in the San Luis Valley, are confronted with what may appear to be an unsurmountable obstacle.

Government officials are ready and willing at all times to offer such suggestions and assistance as will aid the settler who will make his condition known to the Department of Agriculture, Washington, D. C.

More About Secretary Hooker

Many letters have been received by the editor commendatory of our attitude in our issue of November under the title "What Ails the Irrigation Congress." It appears that it only required a moderate amount of publicity to bring out the fact that these same thoughts have been lying dormant in the minds of many who are interested in the future of that organization. One correspondent states that "a change should have been made by electing a new secretary after

the fiasco in point of attendance of the 1912 congress." This correspondent brings out many other facts that it will be as well perhaps to eliminate, but among other features of the letter is the statement that "the present secretary spends much of the time for which he is paid to boost the Congress in writing to former delegates letters of congratulation on their birthdays, and a lot of other stuff little calculated to advance the interests of this once strong organization."

This correspondent, we fear, is rather harsh in some of his criticisms, as there should not, for instance, be any objection to Secretary Hooker writing letters of this character, in view of the fact that they may please the recipients and at the same time strengthen his wabbling fences.

Judging from the general tone of letters received, it is time to protect and protest vigorously against keeping a man in this office who has shown so clearly his unfitness.

Irrigation Increases Food Supply

In these days of high prices, projects for reclaiming desert land and thus increasing the supply of food deserve special consideration. The area under irrigation in our arid region is now about 15,000,000 acres.

In seventeen years it has been doubled. This watered land yields \$200,000,000 worth of products every year. Water is available for the irrigation of 40,000,000 acres more. Since the passage of the Reclamation Act, fourteen years ago, the federal government has expended more than \$100,000,000 in irrigation work. The money has come from sales of public lands, and those who use the water pay eventually the estimated cost of construction.

The results of an inquiry about irrigation were published recently by a committee of the United States Chamber of Commerce. All agricultural products, the committee says, can be grown more successfully on irrigated land than elsewhere, the average yield per acre exceeding that of non-irrigated farm areas by from 10 to 50 per cent. There is scarcely any risk of loss. Crops are not exposed to drought or destructive rainfall. They are not attacked by insects, for the surrounding desert does not breed these enemies. The committee points to the Salt River project in Arizona as a typical example of the excellent work which the federal government has done. There, what was a desert, is now a garden, whose products are sold for about \$4,000,000 a year.

It would be profitable for the nation to add to the 15,000,000 now irrigated the 40,000,000 which can in the same way be made equally productive. Under present conditions the watered area grows

slowly. The committee does not ask for or suggest legislation, but its report shows that the irrigation movement deserves to be stimulated by the federal government as well as by the states in which the arid lands lie.

Chairman Elwood Mead Criticized

Exception has been taken by the Chamber of Commerce of Orland, California, to the recent report of the Committee on Revision, headed by Dr. Elwood Mead, in which the Orland project was, it is stated, placed on a par with the many less successful irrigation districts in that state. It appears from word received from California that the Los Molinos colony has been pointed out in this report as one of the most successful and satisfactory in that state. Orland settlers assert that this report makes it appear that many of the local landholders have paid neither the interest or any sums on the principal of the debt on the property since the initial payment was made, and they declare that this statement was entirely unqualified and that a wrong impression as to the situation has gone out as a result of the report of the Committee on Revision, consequently Dr. Mead is brought under criticism as chairman of that body. In discussing this subject the Orland Register has the following to say:

"There were some who had not met their payments on their principal, but only because the men holding their notes were so sure of their investments that they advised the landholder to take the money and put it into cows or other farm improvements so that he would be in a better position in every way to make the deferred payments at a later date.

The fact that all maintenance charges and construction charges have been paid with as astonishing promptness with scarcely a delinquency, gives the lie to the statement included in the report. The report makes capital of a few minor instances in order to make a case for the advocates of the Australian land plan which, it is reported, will be pushed before the legislature this winter, and which it is the fond hope of those back of the plan will be adopted by the State of California."

This publication goes on to say that Orland is in entire sympathy with the Australian plan and that the Orland district should not be discredited in such a sweeping statement when the facts show that local private interests see fit to put into effect in so far as they are able, this identical movement, viz.: the plan of deferred payments and long-time loans in order that the farmer may improve his acreage to the highest point of development.

The editor of the AGE is not sufficiently familiar with recent work at either Orland or Los Molinos to be able to discuss the quoted comparison of dis-

tracts, but unless conditions have changed since his last visit to these points, Los Molinos is a private project—operated by heavy western coast interests and should not be used by any federal official in comparison with a project controlled by the government, as that comparison on its face would place the members of the Revision Committee—a purely federal institution—in the position of critics of their own or their employer's (the federal governments') plan.

Dr. Mead, as is well known, is a strong advocate of the Australian plan, but it is doubtful if he will accelerate any movement in that direction by an attitude such as is complained of in the report of the Committee on Revision.

Perhaps Dr. Mead and his associates may be able to conciliate the Orland people by a more clear statement of their attitude.

In this connection we are reminded that there is a disposition on the part of many of the leaders among the federal water users to criticise what they term a change of heart on the part of Dr. Mead since he has become closely identified with the "powers that be" at Washington. The AGE would be deeply grieved if such a condition should be proven to exist. If this change has taken place, and Dr. Mead is acting under special instruction from the head of the Department of the Interior, that head should be made to understand that he is there to aid rather than retard development of the man upon the land.

WINS IRRIGATION FIGHT

A decision affecting Colorado and Nebraska water rights, far reaching in its effect, was handed down recently by the United States circuit court of appeals.

The decision held that state lines do not affect the question of priority of water rights and the contention of the State of Colorado that junior appropriators of the state have priority over senior appropriators in adjoining states fails. The decision says that filings first in time are first in right regardless of state lines.

The case grew out of a contention as to rights to water from the Republican river, which flows from Colorado into Nebraska. The Pioneer Irrigation Company, which serves customers both in Colorado and Nebraska, but which was denied the use of water in Nebraska so long as later appropriators in Colorado were needing water, brought the suit to establish its rights, and the decision was in its favor.

It is likely that the case will be carried by the State of Colorado to the supreme court of the United States, as there are other suits between Colorado and Wyoming water users which will be affected by the final outcome. Nebraska users are concerned in the matter not alone from Colorado, but from Wyoming.

ENTRYMEN GIVEN RELIEF BY LANE

Secretary of Interior Voids Order of Land Office in the Greeley-Poudre Case

Franklin K. Lane, secretary of the interior, has notified the Denver land office that he has overruled the action of the general land office denying relief to desert land entrymen holding lands under the Greeley-Poudre irrigation system.

The secretary holds in his decision that while the proposed water rights of the Greeley-Poudre system are in litigation there is not a "reasonable prospect" of entrymen securing sufficient water rights to enable them to comply with the conditions of the irrigation act.

He will allow entrymen involved to proceed with the purchase of their lands upon the fulfillment of the other conditions.

The decision followed an appeal lodged by George W. Gardner from the decision of the general land office, made March 16. Gardner's application to purchase, it was held in the appeal, had been rejected because of the failure of the contemplated irrigation system to materialize, as the result of water rights litigation.

The litigation referred to is the Wyoming-Colorado suit involving the right of the Greeley-Poudre Irrigation Company to divert the waters of the Laramie river in Wyoming to the Greeley-Poudre system in northern Colorado.

The briefs in this suit have recently been completed by Judge Julius C. Gunter and his associates, and the case has been set for a hearing in the United States Supreme Court in Washington, sometime during December.

One peculiar feature of Wyoming's case against Colorado is that it seeks to prevent Coloradoans from using the water of the Laramie river, although the river has its source in the northwestern part of this state.

HAWAII INVESTIGATES SEEPAGE

Hawaii plantations are to cooperate in an investigation to be made into ways to remedy the seepage of water from irrigations ditches, it is announced in a report made by G. K. Larrison, superintendent of hydrography, to the board of agriculture and forestry. This seepage has caused heavy losses to plantations recently.

Among the recommendations made is the consideration of permanent cement lined waterways on the irrigated plantations. Included in the plantations that are asking for the investigations are the Ewa, Honolulu, Oahu and Waialua, on Oahu, and the Pioneer and Maui Agricultural, on Maui, and Kehaha, on Kauai.

IRRIGATION LAWYER LOCATES IN CHICAGO

Edward C. O'Brien, formerly special agent to the attorney-general of the United States, has resumed the practice of law at 1887-1889 Continental and Commercial bank building, 208 South La Salle street, and will specialize in the law of mining, irrigation, water power and Indian lands. Practice in all courts, before government departments at Washington and before committees of congress.

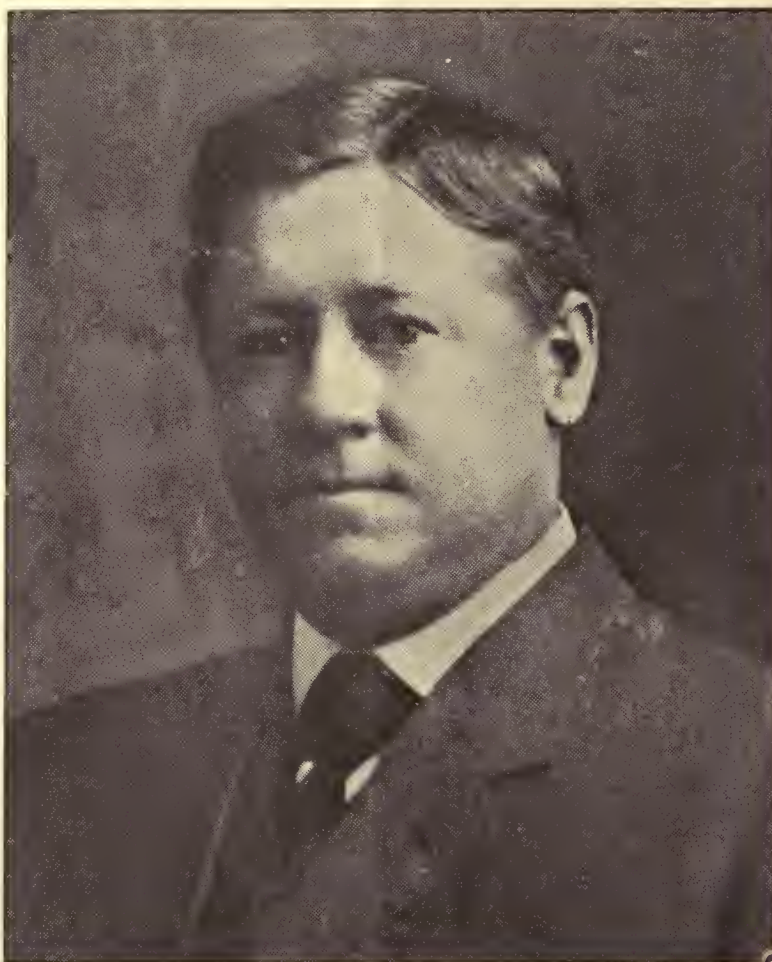
CONSERVING FLOOD WATERS IN NEW MEXICO

By ALICE STEVENS TIPTON

At the present time there are approximately 822,000 acres of land under irrigation in the State of New Mexico, and according to the estimate of the state engineer, the surface waters alone, of this big state, are sufficient to irrigate not less than 4,000,000 acres. This estimate, however, does not include the annual flood waters which sweep down the mountains following a heavy rain or the sudden melting of the snows, excepting only as they go to increase the capacity of the running streams.

It would be difficult to estimate accurately the amount of water annually wasted in New Mexico, through lack of storage facilities to conserve these flood waters.

That portion of the great Rocky Mountain range which extends through the center of the state from north to south, forms a magnificent watershed and innumerable small streams and arroyos serve as conduits through which the waters from the mountains find their way over rolling foot-hills and undulating plains to the larger streams which drain the valley lands. During normal conditions these small water courses are able to carry off all the surface moisture, but when the heavy summer rains fall in the higher ranges, or when the snows begin to melt in the spring, there is apt to be a surplus of water which gradually increases in volume until it not infrequently becomes a raging torrent, tearing down these shallow arroyos and sweeping everything before it, and while it serves as a cleansing stream in carrying off accumulated refuse, and never lasts long at a time, it sometimes does serious damage to crops and roadways that



MR. ROBERT P. ERVIEN, COMMISSIONER OF PUBLIC LANDS OF THE STATE OF NEW MEXICO.

Many of the state lands of New Mexico are so situated as to be available for agricultural purposes if the flood waters were conserved for irrigation. Other tracts of these public lands come under the dry farming methods of cultivation.

stand in its path, and is one of the difficulties with which some of the farmers of New Mexico have to contend. It is safe to assume that there is enough water wasted in this manner annually, if it could be properly conserved, to irrigate all the lands which align these small water courses; lands which without irrigation are not so profitable for agricultural purposes.

In many cases these flood waters follow courses which are nothing but dry arroyos excepting during these periods of flood, and to any one not acquainted with this peculiarity of New Mexico, it would seem ridiculous to attempt, or even to suggest

the controlling of flood waters in a dry wash. But it has been done already, with such success in a number of cases, that its practicability is no longer a matter of doubt, and, wherever other conditions are favorable to such a project, it is of great value to the lands in more ways than one. While conserving the flood waters for irrigation purposes it also prevents their becoming a menace to growing crops.

In all cases, however, it is of paramount importance that the sub-soil shall be of such a character as to insure the permanency of any dam and reservoir which might be constructed, else discouraging results are sure to follow. In volcanic formations there is danger of the waters percolating through the soil and all one's work might go for nothing in a few hours' time. But, in the construction of either a dam or reservoir it is always advisable to have the services of a competent engineer, one thoroughly familiar with local conditions.

Again, separately, these dry arroyos may conduct but a small amount of flood water at a time, but taken collectively, their capacity swells to large proportions, and by constructing a dam and storage reservoir at some favorable point where the combined waters of many such water courses may be conserved, the results are eminently satisfactory.

In Taos county, in the northern part of New Mexico, there is such a project now under way which is calculated to irrigate about 6,000 acres of land which, in its present condition, is utterly unproductive, and yet it has been proven that whenever these lands have been watered they have produced generously. The water to be conserved under this project will be derived almost entirely from floods following summer rains, and the water shed is composed of several thousand acres of rolling hills through which many small arroyos and washes now conduct these flood waters into a deep ravine with an outlet in the Rio Grande. By constructing a wide dam and large reservoir it will be possible to conserve these waters, and through diversion ditches to conduct them on to the lands referred to. Much of the work on this project is already finished and the entire scheme is now nearing a successful completion.

In Colfax county the owners of one of the largest stock ranches in the State of New Mexico have constructed a dam and reservoir at a favorable point along a small mountain stream, which serves as a main drainage system to many thousand acres of surrounding foot-hills and rolling lands, and the flood waters which annually rush down these hillsides during the summer rains are carried through gullies and arroyos into this stream which, before the construction of this dam, became a swollen torrent and a serious menace to the ranch property. There is now conserved in this storage reservoir approximately 5,000 acre feet of water, enough to secure the crops against at least two years of any possible drouth, as well as affording ample water for use of livestock when the streams are low. This is a practical example of what may be accomplished along this line, and one of the best evidences of its feasibility.

The Eklund dams and reservoirs, in Union county, in the northeastern part of New Mexico, are another illustration of what may be done in this regard, and are constructed along similar lines to

the one above referred to. Where vast quantities of flood waters once swept down the hillsides, unchecked, following the lines of least resistance and forcing an outlet through sheer strength of its mighty impulse, often leaving destruction or damage in its path, now may be seen a series of well constructed dams with diversion ditches carrying these flood waters onto the thirsty soil, over which it once rushed with such disastrous results. Tamed by the genius of mankind, these flood waters become the servant of men and a first aid to the production of larger and better crops.

Another private project of this character is the Arroyo Hondo dam and reservoir in Santa Fe county, which gives promise of being the means of bringing under irrigation a large acreage which now either depends upon dry farming methods, or is not cultivated at all, being used chiefly for grazing purposes. The breaking up of much raw land into cultivated farms and orchards will follow the suc-

cessful carrying out of this project, and will be of great benefit to the state in general and to Santa Fe county in particular.

Another feature of these dams and reservoirs, and one which appeals to all true sportsmen, is the fact that many beautiful lakes are formed in otherwise arid places, where wild ducks and geese gather, and in which game fish are planted, affording fine sport for hunters and



Four-way Distributing Box of Concrete, Receiving Discharge From Artesian Well, El Paso, Texas.

anglers during the open season.

More serious attention has been directed to the conservation of these flood waters in New Mexico since the launching of the Elephant Butte project on the Rio Grande, the Carlsbad project on the Pecos, and the Rio Hondo project on that river, by the United States Reclamation Service, within the past ten or fifteen years, and as an indication of what may be accomplished under proper irrigation methods in New Mexico, a few figures taken from the Reclamation Record for November, 1916, may be of interest. According to the statistics therein presented, the cash value of the total production for 1915, under these three Government projects, was as follows:

Carlsbad—Vegetables, fruits, cotton,	
cane and hops.....	\$ 245,684.00
Cereals, hay, grain and forage	140,376.00
Rio Hondo—Cereals, hay, grain and	
forage	14,943.00

(Continued on page 27)

HOW CAN GREATER EFFICIENCY IN IRRIGATION MANAGEMENT BE SECURED?

By W. O. COTTON, Idaho Falls, Idaho

It will be impossible in the allotted space to tell what it has taken me several years to study and experience to learn, and the writer does not intend to solve this problem in these few lines, but if this paper succeeds in provoking a thorough discussion of the subject, it has fulfilled the purpose for which it was written.

Moreover the subject of irrigation management is so closely interwoven with engineering, the physical, legal, administrative and human problems, that it is very difficult to treat these in their regular sequence.

One of the principal features of an irrigation district is that the system shall be operated for the common good of all—without undue profit to anyone, and that each patron of the district shall pay in proportion to the benefits received. It is a faithful saying that "Almost every undertaking that fails to make a profit or that fails in business, can be traced directly to waste in management and operation." This is applicable to the irrigation district as well as any other business, as the profits, if any, are enjoyed by each patron of the district by a reduction in the assessment.

Assuming now that the engineering, physical and legal problems have all been met and correctly solved in the construction of the irrigation district, there are still left two important problems, namely, administrative or operation and maintenance, and the human element.

The thing that goes the farthest towards making a successful system, that costs the least and does the most, is the successful farmer. Now, how can we better conditions for the farmer? The farmer has plenty of work to occupy his attention on his farm without being hampered with the distasteful task of visiting his neighbors on a quest for water in their neighborhood lateral where the control of the district management ceases.

There has been, and will continue to be, a strong tendency toward the division of labor here, as in commercial and manufacturing industries, and the natural point of such division, from the viewpoint of efficiency, justice, harmony and economy, is at the farm headgate. How to operate a canal system so that each irrigator shall receive water when and where

his crops demand it, is a perplexing problem, inasmuch as it calls for a knowledge of "team play," measurement of water, and duty of water, with all of their intricate business details, and just how to arrange a force to accomplish this without friction and at a cost the irrigators will pay, is by no means a small matter. These are questions the solution of which, in a large measure, determines the success or failure of the system and usually take years of study and experience to successfully master.

The importance of forestalling breaks, erosion of banks, weakening of structures and accidents of any kind, cannot be too forcibly emphasized, and oftentimes new construction is a good investment, as the per-

cope with the engineering problems, and who has enough assistance (responsible directly to him) to enable him to carry out effectually the general plans and policies.

Questions concerning the measurement and division of water probably give rise to more trouble than all other questions combined in an irrigation district. While frequently the amount of water in question is small, it may be, and often is, a serious matter. It certainly is a source of irritation, causing constant friction between the management and the consumer, as well as between neighbors. The stream in the ditch on the opposite side of the fence always looks the larger. A more widely distributed knowledge of methods, to-

gether with a universal installation and use of the most simple and accurate measuring device, will remove much of this trouble, as is already in evidence. I say "simple," because the more readily the farmer understands the device the more confidence he has in the system, and eventually in the manager; this system should be installed and operated to the farm unit and not leave part of the patrons of the district to deliver their own water through several miles of community laterals after paying their proportion of the total cost to the district. I have in



Concrete Lining and Distributing Gates. Canal of Truckee-Carson Project, Nevada.

manent work costs less than the extra maintenance on poor work. "Safety First" is the slogan.

Irrigation district management, I take it, does not differ widely from irrigation management on government, state or private projects, except that the laws governing these projects are different in several respects, the irrigation manager being more amenable to the people in the case of an irrigation district than in other forms.

The growing opinion is that the easy-going, haphazard fashion of operating the small canal system, would be criminal in connection with the steady flow of a canal carrying an entire river; hence, it is being recognized that the operation and management of the district, instead of being a sort of neighborhood affair, is a distinct profession. There must be a strong central organization headed by a capable manager, who is removed from the danger of being influenced by individual water users, who can

mind a well managed district, where payment is made on the amount of water used in acre foot units; the water master knows twenty-four hours in advance what water he is expected to deliver; this he compares with the capacity of his canals and deals it out to the riders on the main canal accordingly; these men are charged with the water and through the use of frequent gauging stations on the system; the exact loss is determined and the net available is in turn dealt out to the various laterals where the proper amount of water is charged to the rider on each lateral. The losses are figured to such a nicety and the measuring device on the individual turnouts check so well (with simplicity in their favor) that complaints seem to be down to a minimum. If Resolution No. 2 of the Denver Irrigation Conference of 1914 is to be discussed, which reads as follows: "Resolved, that uniformity of district laws be made so that

the several states in the United States adopting the district laws will have less trouble with finance," I would suggest benefits received be based on water used in acre foot units, as this will come as near encouraging the economical and beneficial use of water as any method yet tried in Idaho.

Duty of Water: Irrigation is the art of supplying water artificially to the land, and the fact that the duty of water depends on local conditions and in turn the better the duty the more acres can be irrigated and the more crops produced, gives sufficient incentive for the intelligent student to determine the duty in his own locality by long and tedious study of the irrigational system in hand, irrigation methods, technical and practical, cropping, application of water, drainage and irrigation law, and last, but not least, the water user.

We are learning by degrees through trial and failure, the necessity of "team play" in the distribution of water. To cultivate and encourage this team play, the following should be given some consideration: Organizing and instructing subordinates, maintaining and operating in a practical manner, gathering crop reports and visiting the farmer on his land.

Few water users can take the same viewpoint of canal operation that the professional manager does; as, for instance, the manager is looking after the interests of many, scattered over a large territory, trying to give the farmer the best and most economical service, and at the same time looking after the best interests of the system for the future. All of this is out of the farmer's line and he often takes exception to it on account of lack of knowledge. Too often the farmer does not realize the fact that a cheap manager may cause partial crop failure, which may run from one to ten dollars per acre on a good many thousand acres; he fails to realize the best investment is intelligence, and in order to keep this man they must pay a wage comparable with the position he holds. To overcome this difference of viewpoint or misunderstanding, the manager must secure the confidence and respect of the water user—he must keep in touch with them—he should take time to show the farmer why the installation of measuring devices is necessary for the successful division of water and will not deprive him of any of his water. The gathering of crop records in the fall gives a very good opportunity for the manager and water user to get together and the value of these records, when properly taken, will justify the cost.

It has been my experience that young graduates from agricultural and engineering courses who are willing to begin at the bottom as ditch riders or water masters, make efficient help and are thus trained for the position of manager. However, character, habit, ability and diplomacy should be considered and given equal, if not greater weight, than the technical training, as the technical man, without these important qualifications of human nature, can make the manager much trouble and oftentimes much expense to the district. In-

structions to these men should be carefully and thoughtfully written with a view of giving good men considerable latitude and in forcing every rule and regulation.

The measurement and delivery of water should go hand in hand as oftentimes the same device which measures the water may serve also for division. It should be clearly understood that no one method will apply to all conditions; methods suitable to a canal of heavy grade and with heavy fall in the laterals should not be used where the fall is slight in the canal and service ditches. Devices to be used where the water is clear may be impracticable in streams carrying large quantities of silt. A poor method may work out satisfactorily under a manager who has experience and good judgment and likewise a good system may fail under poor administration; hence one of the necessary requirements in irrigation management is to educate the subordinate in a practical manner, so that they have sufficient understanding of the principal of measurement to apply them to the exceptional case. This will tend toward gaining confidence of the water user, which is a long step in the right direction; hence an important step is taken toward "team play" when the water user understands more of the technical in measuring and delivering his water and the manager likewise obtains the viewpoint of the farmer. The farmer then understands and sees the necessity of the measuring device to effect a fair and equal distribution of all waters in the irrigation district.

INSTRUCTIONS TO WATER-MASTERS

1. Treat each patron with due respect and courtesy, but instill in him the fact that we are running and controlling the canal.

2. Only by the exercise of patience, judgment and discretion, by the men in the field can unpleasant controversies and complaints be avoided, or at least reduced to a minimum, and therefore, a spirit of friendliness and cooperation toward the patrons is enjoined upon all district employees.

3. Keep in touch with the patrons, and if complaints are made, listen attentively, and report same to office, under head of "General Remarks" in your book of records, but do not involve yourself if any allegations.

4. Refer all applications of patrons for headgates or measuring devices to the manager.

5. Encourage patrons under sublaterals and community ditches to organize and appoint their own water-masters, with authority to represent them, order their water, distribute it, or turn it over to the district.

6. If questions arise which cannot be decided by the water master, he will make proper memoranda of the same, and call same to the attention of the manager as soon as possible; if the manager does not reply within a reasonable time, his attention should be called to the matter a second or third time.

7. Do not permit any structures of any kind to be placed in, across,

along or upon any canal right-of-way or canal without the approval of the manager.

8. In case of emergency, such as breaks in the canal, employ help if necessary, in order to make repairs promptly, sending in complete report of the break and the length of time water was shut off for repairs. Send in time of men and teams employed as soon as possible.

9. Cover daily all canals, laterals and creeks in your division; inspect all structures and openings for possible leaks; remove all weeds, brush and other obstructions from the ditches, gates and checks, in order to keep the system clean and in good working order.

10. Read all gauges and regulate all headgates in your division, making delivery promptly to farmers in accordance with their written orders on cards furnished for that purpose; these cards must be endorsed by you, giving the date and time the water was changed, then sent in to the office.

11. When you receive orders from patrons to increase or decrease their water, consider first the safety of the canal and the people below, or (in other words) maintain a steady stream. When you can consistently give or receive water on less than twenty-four hours' notice, do so, but do not take chances on breaking the canal or robbing the man below.

12. Each water master must report conditions actually existing on the canal each night.

13. In record book shall be shown the daily record of water flowing in district ditches, patrons' headgates and waste ditches.

14. When we are short of a full stream, ascertain the amount in per cent we are short and cut each gate this amount.

15. When the manager gives an order to lock gates and regulate the flow, this means every gate.

16. Each water master must understand the law pertaining to the delivery of water. Section 7149 reads as follows:

"Any superintendent or any person having control or charge of the said ditch, canal or conduit, who shall willfully neglect or refuse to deliver water as provided in Chapter Four of Title Nine of Civil Codes, or person or persons who shall prevent or interfere with the proper delivery of water to the person or persons having a right thereto, shall be guilty of a misdemeanor and, upon conviction thereof, shall be subject to a fine of not less than twenty-five dollars, or more than one hundred dollars for each offense; and the money thus collected shall be paid in to the school fund of the county in which the misdemeanor has been committed; and the owner or owners of such ditch, canal or conduit shall be liable in damages to the person or persons deprived of the use of water to which they were entitled as provided in said Chapter Four of Title Nine of Civil Codes."

17. Read these rules carefully and follow out the instructions contained therein, as no deviation therefrom will be tolerated.

WATER PENETRATION IN THE GUMBO SOILS OF THE BELLE FOURCHE RECLAMATION PROJECT

The gumbo soils, which cover over 7,000,000 acres in South Dakota, recent investigations on the Belle Fourche Reclamation Project establish, swell so rapidly when wet as to make the top layer nearly impervious to water. For this reason after a field of this soil has once been covered with water, little benefit can result from having water continue to stand on or flow over the soil. Because of this action of these gumbo soils, O. R. Mathews, assistant Dry-Land Agriculture Investigations, Bureau of Plant Industry, makes, in U. S. Department of Agriculture Bulletin No. 447, the following recommendations regarding the treatment of these soils under irrigation and dry-land conditions:

(1) Water should be applied only when the surface is dry.

(2) The quantity of water absorbed will depend upon the dryness and consequent cracked condition of the surface soil.

(3) After a field has once been covered with water, little further absorption takes place, and no benefit can result from having water stand on or flow over the soil for more than a few minutes.

(4) The depth to which the water will penetrate depends upon the depth to which the soil has been dried and cracked.

The following points apply to the cultural practices for these gumbo soils under either irrigation or dry-land conditions:

(1) No particular method of cultivation will be superior to others in influencing the quantity of water absorbed, since this depends upon the degree to which the surface soil is dried and cracked. The soil after harvest is usually so dry that penetration takes place very readily, and any ordinary quantity of rain that falls is absorbed regardless of the cultural treatment.

(2) Since the dry soil is naturally broken up to depths as great as would be reached by either deep plowing or subsoiling, these operations can be of no great benefit in water absorption.

(3) Some method, such as dynamiting, by which the soil below the cracked area could be broken up, might result in a temporary increase in the depth to which water could easily penetrate. The natural swelling of the soil, however, would cause it again to become compact every time it was wet. This would make it necessary for the operation to be repeated each year, which would involve an expense too great for this method ever to be considered seriously.

NATIONAL FOREST ELIMINATION

As a result of recommendations of the Secretary of Agriculture, based upon approved classification reports submitted by the Forest Service, 19,840 acres of land have been eliminated from the Routt National Forest in northwestern Colorado by a Presidential proclamation. This action is in accordance with the policy of putting all lands in the National Forests to the use to which they are best suited. The area in question is located in what is known as Ham's Creek Basin, or Elk River Park, about 25 miles north of the town of Steamboat Springs, and consists chiefly of grassland with a small amount of scattered woodland.

The elimination comprises practically a solid block from 6 to 8 miles long and about 4 miles wide. Approximately one-third of the entire area is already alienated and in private ownership. Forest Service reports on the classification of the area show it to have little value for watershed protection or other National Forest purposes. The greater portion of the soil itself is more or less adapted to cultivation, but on account of the high elevation and unfavorable climatic conditions it is believed that the area has only a low value for practical agriculture.

A classification of practically all the National Forests is being made by the Forest Service in order to determine the character and suitability to agriculture of the land which they contain.

CORRESPONDENCE

Editor THE IRRIGATION AGE:

One of my neighbors has shown me a copy of THE IRRIGATION AGE sent to him and I wish to have my name entered on your list of subscribers. Enclosed please find check for \$1.00 in payment of subscription.

I heartily endorse the action of the executive committee in making THE AGE official organ of the National Federation of Water Users' Associations, as it will give us a wider court in which to plead our cause. If we ever obtain justice, unbiased by political exigencies, we must get it by an appeal to the highest of all tribunals in this country, the court of public opinion. Heretofore we have been fighting an unequal battle chiefly because the Reclamation Service, at our expense, has been maintaining a very competent press bureau, which has been devoting its energies to misleading the public and misrepresenting the settlers. Why, just a few months ago a Reclamation official is reported to have told an audience in New York City that the only chance left for a poor man was to take up a reclamation farm and he tried to create the belief in the minds of his hearers that \$500 was ample capital. And then our dear beloved director will declare that the trouble with the projects is that we have too many men with no experience and little capital.

Press agents make a campaign for that kind of settlers and the director insults them because they yield to the blandishments of the press agents.

So more power and a wider circulation to THE IRRIGATION AGE.

H. E. CULVER, Fort Shaw, Mont.

If you want to keep in touch with all sides of the Reclamation Problem send \$1.00 for one year's subscription to the Irrigation Age, 30 North Dearborn street, Chicago.

(Continued from page 23)

Vegetables, fruit and cane	17,783.00
Elephant Butte—Cereals, hay, grain and forage.....	749,698.00
Vegetables, fruit, beets and cane.....	1,103,389.00
Total	\$2,271,878.00

And this return was made an entire year before the completion of the Elephant Butte project, which is the largest storage reservoir in the world, irrigating 180,000 acres of land, 110,000 of which are in the state of New Mexico. Of course these projects simply conserve the waters of established streams, which are augmented annually by flood waters from the many arroyos hereinbefore mentioned, but the dams and reservoirs are so constructed as to conserve any amount of excess water and control its distribution, thereby avoiding overflows and drouths.

From what has already been accomplished in New Mexico in the way of conserving these flood waters in remote districts where Government projects would be difficult to secure, and where but a comparatively small area is affected, it is safe to assume that a more systematized method of constructing community dams and reservoirs, lessening the cost per capita, ultimately will prevail, and these erratic flood waters then will be led through green fields and verdant pastures under restraint of diversion ditches, to become a blessing to mankind. Where now vast tracts of land are practically without any water, then shall they blossom like the rose and give forth a rich abundance of foodstuffs for man and beast.

New Mexico is a big state with wonderful possibilities, awaiting the magic touch of a golden wand that will waken her to new life and greater activity, and in many ways the conserving of these flood waters will tend to hasten her material development.

SPRAYING DOES PAY

The subject of spraying fruit trees and small fruits has been thoroughly discussed and written up in all its details and different phases in fruit growing periodicals and agricultural journals. Moreover, every fruit-growing state has its own experimental station, agricultural society or college from which bulletins are issued free to its residents on application. These documents give results of practical experiments, different formulae to be used for fighting all kinds of insects and enemies of tree and plant life in the most approved manner. They also contain complete information descriptive of the appearance and habits of insects and fungous growths, the formula best suited to combat them successfully and how to apply it. Further than this there has been enacted in some states and proposed in other compulsory spray laws compelling owners of fruit trees to spray them between certain seasons of the year both for the extension of the fruit-growing industry and the protection of those possessing valuable orchards.

All of these conditions have established beyond question the fact that spraying does pay and is necessary to insure perfect fruit. But, to make a success of spraying, much attention should be given to the spray outfit, being careful to select the best adapted to meet the particular conditions that may exist.

Myers' Spray Pumps, Nozzles and Accessories are the result of years of experience and experiment. They have been developed with spraying itself, in line with spraying needs and have withstood the test made of them for service and reliability. Moreover, the line is complete, consisting of knapsack, bucket, barrel or power outfits that will meet every requirement, also having many patented and advantageous features.

The IRRIGATION AGE calls particular attention to the excellent catalogue which can be secured on request, by addressing F. E. Myers & Bro., of Ashland, Ohio.

NEWS NOTES FROM IRRIGATION PROJECTS OF THE COUNTRY

California

Jefferson J. Graves and Walker C. Graves, Jr., have purchased approximately 2,000 acres of land in the second sub-division of the Kings River Thermal tract. The land lies in Fresno county, and the original item of consideration of the property was about \$130,000. It is understood that the improvements planned will cost about \$100,000 more. A modern system of irrigation has been planned and modern machinery with electrical pumps will be supplied for irrigation purposes.

Thos. H. Means of Berkeley, an expert on irrigation, has been engaged by the directors of the Anderson-Cottonwood Irrigation District to figure on how much money will be needed to complete the system. Owing to the great advance in the price

of materials, notably in reinforcing steel, the money realized from the sale of \$480,000 in bonds will not be enough to complete the system.

Some of the farmers in the vicinity of Bishop are considering the organization of a drainage district. Hundreds of acres once requiring irrigation are being greatly changed and some of it reaching the stage of uselessness, due to seepage from irrigation of higher lands in some cases, to overuse of water in others. The useable acreage can be materially added to by systematic drainage.

W. A. Kraner, a San Francisco contractor, has been awarded the contract for the construction of the first unit of the Terra Bella irrigation district, to be completed by July 1, 1917, at a cost of \$376,000. The Contrac-

tors Securities Company of Los Angeles purchased the \$1,000,000 in irrigation bonds at 97 and accrued interest. At the present time only \$600,000 of the bonds will be issued, sufficient to pay for the proposed system of deep wells and diversion works for which the contract has been let.

The Dixon Irrigation Bureau, in behalf of the proposed Irrigation District, has filed on all the Putah Creek water rights in order to protect any future needs by the farmers of Northern Solano county. While efforts are now centered on organization of only a 20,000 acre district, it is believed that the area will have to be widened in time.

Surveys for a \$1,000,000 irrigation project have been started by a com-

(Continued on page 28)

(Continued from page 27)

pany composed of M. V. Helwick, William Gregg and M. L. Hazzard of San Dimas. In April an application was made to the State Water Commission for permission to appropriate 2,000 second feet of water in San Dimas canyon, tributary to the San Gabriel river, for irrigation purposes. It was planned to construct an arched concrete diversion dam 130 feet high to form a reservoir with a storage capacity of about 17,000 acre feet. This will be located in the Puddingstone Canyon district. The cost of the dam and the reservoir is estimated at about \$350,000. There will also be a canal four miles long, a tunnel 6,000 feet long through the mountains separating San Dimas and San Gabriel Canyons, and a pipe line or flume from the mouth of the tunnel to the reservoir. The irrigating will be done in the vicinity of Baldwin Park and Covina.

The first contract for work on the Waterford Irrigation District Canals was let recently to G. W. Price & Company of San Francisco, who will build part of the canals for \$30,000. The district has now disposed of all its bonds, the Union Savings Bank of Modesto taking \$100,000 worth at 97 and H. M. McDannold of San Francisco buying the remaining \$365,000 at 97.1. The district received one bid of par, but this bid was rejected, as it carried with it the right of the bidder to dictate to whom the contract for work should be given.

Colorado

The Grand Valley Irrigation Company, with offices in Grand Junction, made public recently a splendid report of its financial condition. The company has an ample fund on hand for payment of its bonded indebtedness and will close 1916 with a surplus in the general fund.

Twenty thousand acres of land in the Routt National Forest has been thrown open to settlement through an order issued by President Wilson recently. The land is located in the northeast corner of Routt county, about twenty-five miles north and west of Steamboat Springs, and is known as the Ham creek basin. It is described as high rolling land, consisting chiefly of grass land and scattered woodland and is easily adapted to short season agriculture. This land may be taken up under the enlarged homestead act in 320-acre tracts or as desert land, or under the stone and timber act. The area comes under the jurisdiction of the land office located at Glenwood Springs, where filing may be made.

At the next regular meeting of the stockholders of the St. Vrain and Denver Municipal Irrigation Company, a proposition will be voted upon to assess the shareholders to pay the bonds of the company, or at least the interest on the bonds. The board of directors has already decided that this should be done, but it is necessary to have the consent of the ma-

jority of the stockholders in order to levy the assessment.

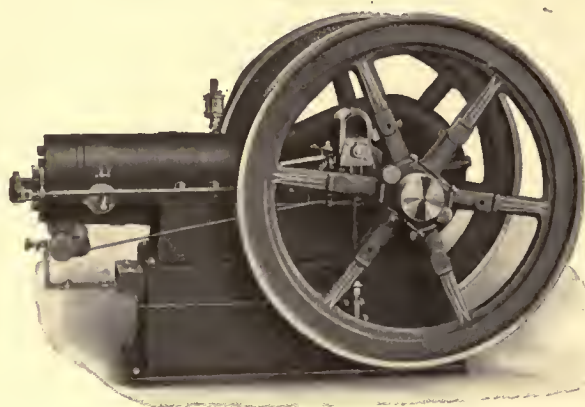
Idaho

The Ontario-Nyssa Irrigation Company, owners of what is known as the Shoestring Ditch, have recently installed a fourth pump at the big pumping plant. This plant now has a battery of three pumps, each 18 inches in size. The one recently installed is a 20-inch pump. The new pump was found necessary because much new land is being cleared and put under cultivation.

In a report filed recently with the state land board, State Engineer Smith protested against the state's permitting the Birch Creek Irrigation Company to segregate 15,000 acres of land in Fremont county under the Carey Act. The engineer states that the irrigation company has only a sufficient water supply to care for 12,000 acres, questioned the titles to the water rights and declared the dam site was not feasible.

J. Jester of Caldwell, who for six years has acted as secretary of the Pioneer Irrigation District, has resigned, and Mr. F. L. Evans of Greenleaf has been selected as his successor.

The Gem Irrigation District of Owyhee county has asked the state land board to authorize a contract between the state of Idaho and the irrigation district for the construction (Continued on page 29)



The Successful Kerosene Engine

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They operate on Kerosene, Distillate, Motor Spirits and other cheap oils, using less than one pint of fuel per horse power hour on one-half to three-quarter load and full load.

They operate with a clear, clean exhaust, regardless of load conditions, the same as a gasoline engine—a feature found only with the Lauson and which shows that all the oil is vaporized and used during each cycle, consequently no raw fuel is left in the cylinder to dilute the lubricating oil. For this reason Lauson Kerosene Engines are equally as long lived as a gasoline engine.

Being of the throttling governor type they regulate as closely as any ordinary steam engine and give a steady, smooth power.

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United States Press Bureau
Rand McNally Bldg. Chicago

of a \$300,000 power plant at the Arrow Rock dam for furnishing the Gem district with electricity for pumping purposes. Such a contract would have to be taken before the legislature for the purpose of obtaining the desired appropriation. The plant, according to the present plans, would be paid for by the sale of 10,000 acres of land owned by the state within the district, and which it is said would readily sell for \$40.00 per acre as soon as the plant was installed. Owners of land in the Gem district have been purchasing power for pumping purposes from a private corporation, but it is claimed that the maintenance cost would be reduced nearly two-thirds if the district could own its own plant, thereby making the tract one of the most attractive projects in the state from the standpoint of the investor and homeseeker.

Montana

Contract has been awarded to Mendenhall, Bird & Co., of Springville, Utah, for the construction of schedules 1, 2 and 3, earthwork, laterals and sublaterals on the Flathead Irrigation project.

The work involves the excavation of 160,000 cubic yards of material, the contract price being \$44,541.

An appropriation of \$25,000 for improving and enlarging the irrigation system at Fort Keogh remount station has been made by congress.

Contract has been awarded to Welch Bros. & Hannaman, Kalispell, for schedule 4, structures on the Flathead irrigation project. The work involves 425 cubic yards of reinforced concrete; 1,100 square yards of paving; 1,100 linear feet vitrified pipe; placing 64,000 feet of lumber; 2,300 linear feet of steel flume and 36,000 pounds of steel, and 4,400 cubic yards of excavation. The price of the contract is \$17,255.80.

Work upon the erection of concrete structures on the Greenfields division of the Sun River project, which was suspended last July when the contractors, the West Coast Construction Company, and Hans Pceson, gave up the work, will be resumed at once by the sureties upon the original contractor's bond. E. J. Erickson and

Wm. Fransom, both of Seattle, Wash., have recently executed a new contract for the work. The original contractors had done about 2 per cent of the work when they suspended operations. The whole amounts to about \$66,000. It will be impossible to perform much of the contract this winter, but same will be rushed to completion next spring.

Oregon

Bonds in the sum of \$1,500,000 for the successful completion of the Ochoco irrigation project have been authorized by a vote of 56 for and 28 against the proposition by the land owners of the district. The bonds will bear 6 per cent interest and will mature in 20 years. Owing to the fact that all the land in the district is privately owned and more than 36 per cent is already in a high state of cultivation, little difficulty is anticipated in the sale of the bonds.

A new-irrigation unit has been arranged for by Mrs. Van Brimmer, which will take in 430 acres of land lying north of Whitelake. A pump-

(Continued on page 30)

Chicago House Wrecking Company

Offer these and many other snaps, available at once for immediate shipment

3—150 H. P. Erie City boilers with under-feed stoker system.

20 miles of 20 in. Spiral Riveted Steel Pipe, standard lengths—10 gauge, 9/64 in. thick—baked on asphalt coated. Root bolted wrought steel joints. Product of Abendroth & Root.

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The above equipment was secured by us in our purchase of a complete water works; in operation less than 30 days. Write for special quick sale prices.

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3,500 Sections of Steel Pipe, 12 in. to 42 in. diam. Made up for an expert but never shipped; water proof corked seams, double riveted.

10,000 Standard Iron Body Valves—Foot Valves, Check Valves, Globe Valves, Gate Valves, Cross Valves, Float Valves. Made by Crane, Kelly & Jones, and Chapman Valve Co.'s All in good condition, having never been in use. Priced at 75% off the standard list.

Our complete 160-page equipment book contains our latest list of items and material secured in our numerous big purchases. Everything for mining, contracting, irrigation and plant equipment of every kind. Ask for complete list No. E.N. 301.

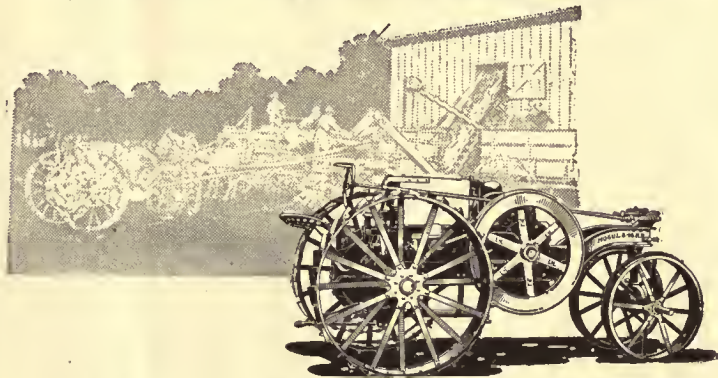
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A Plain Statement of Fact



Mogul 8-16: \$725 Cash f. o. b. Chicago

At the present prices of gasoline and kerosene, no farmer can afford to use a gasoline tractor. Gasoline averages now over 100 per cent higher in price than kerosene and is likely to go higher rather than lower, according to men who know the oil business.

Again, it is neither safe nor economical to use kerosene in a tractor not specially designed to operate on kerosene. Merely changing the fuel mixer is not enough; the design of the whole motor must be changed.

Mogul kerosene tractors and gasoline tractors of equal power sell for about the same price and use practically the same amounts of fuel. On that basis a Mogul 8-16 tractor saves each year, in fuel bills alone, about a third of its price.

If you are considering the purchase of a tractor this year, give these facts careful study, from every point of view, before you spend your money.

Mogul tractors are designed specially to operate on kerosene and to give their users the full benefit of this advantage. There are two sizes—Mogul 8-16 and Mogul 12-25. Write us for the story of kerosene before you buy any tractor.

International Harvester Company of America

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(Continued from page 29)

ing plant will be installed and the ditches constructed before the next irrigation season. The water users under the proposed unit get a water right by paying \$12.50 an acre to Mrs. Van Brimmer and paying the cost.

A permit to use the waters of John Day river for the irrigation of 1,200 acres of land located near Mount Vernon, Grant county, was issued recently by State Engineer Lewis to the Blue Mountain Ditch Company.

The Squaw Creek Irrigation Company of Prineville has filed an application with the state public service commission for authority to increase its rates from 35 cents per acre foot to 60 cents per acre foot, contending that it has operated at a loss under the rates in effect.

Trustees of the Talent-Ashland irrigation district, recently organized, have procured the services of Contractor C. E. Bade to begin work at once on preparation for the irrigation of 5,000 acres of the unit during 1917. Unappropriated water from Emigrant, Ashland, and Neil Creeks will be used for that purpose.

The Middle Fork Irrigation Company, which operates over fifty miles of ditch in the upper Hood River Valley, has elected the following board of directors: C. E. McIntosh, J. R. Barroll, W. L. Mason, M. O. Boe and C. T. Rawson. The report of the secretary showed that the company has operated during the past season at a substantial profit. The irrigating ditches of the company run practically through level land and the operating and maintenance costs have been reduced to a minimum.

Here's Something New about California For You

Two parties of Eastern farmers saw California under my personal escort last fall. It was not a land-selling trip—it was solely for investigation.

We were guests of over forty local communities. Their Chambers of Commerce and Boards of Trade provided the automobiles and guides who showed us the agricultural activities in their neighborhoods.

We saw irrigated fruit farms. We saw alfalfa making large yields under irrigation. We saw diversified farming with its sure returns paying still better because of irrigation.

A Book of Pictures

taken on this trip is now ready for free distribution. We would like to send you a copy.

You can prolong your active business life at least fifteen years in California. It is a country where you can farm twelve months in the year. You need not spend a large share of your earnings just to keep warm.

Write me today. Let me help you plan your trip. Reduced fares next Spring and Summer will give you a chance to see the San Diego Exposition and agricultural sections of California at small cost. Winter tourist fares now in effect. Ask all the questions you want and say "Send Farmers' Special Book."

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2284 Railway Exchange, Chicago.

Texas

Ward County Irrigation District No. 1 has issued bonds to the amount of \$480,000 and contract will be let in the near future for Rocky Ford canal and dam, and for a protection levee on the east side of the Pecos river. John B. Hawley, consulting engineer of Barstow, is in charge of the work.

W. T. Thompson, living near Snyder, Texas, is planning to install an irrigation system to water 200 acres of land.

Washington

The Selah-Moxee Canal Company will expend upwards of \$40,000 in replacing old wooden flume with metal flume during the coming year.

The Keystone Irrigation Company has made application for the first water district to be organized in this country. It proposes to irrigate about 4,000 acres in the vicinity of Keystone and at the foot of Sprague lake. The principal promoters are Messrs. Stone and Funk of Keystone, and Mr. Goff of Colfax.

Alfalfa for profit

**"One-Half the Alfalfa Seed
Sown is Wasted Every Year"**

This statement has been made by many recognized Alfalfa experts—men who know what they are talking about.

They say that they see cured better stands of Alfalfa with 10 lbs. of seed drilled with the Superior Special Alfalfa and Grass Seed Drill than with 20 lbs. of seed sown broadcast.



THE SUPERIOR 20 X 4 SPECIAL ALFALFA AND GRASS SEED DRILL

There are 20 discs on this machine set 4 inches apart. The construction is such that all the seed is sown at an even depth, and an equal amount of seed in every furrow.

None of the seed is wasted, when drilled in the ground with a Superior Alfalfa and Grass Seed Drill

REJUVENATES OLD ALFALFA FIELDS

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Thirty-Second Year

THE IRRIGATION AGE

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THE IRRIGATION AGE

With which is Merged

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MODERN IRRIGATION

THE IRRIGATION ERA

ARID AMERICA

THE WATER USERS' BULLETIN

THE DRAINAGE JOURNAL

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THE IRRIGATOR

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Official organ Federation of Tree Growing Clubs of America. D. H. Anderson, Secretary.

The Executive Committee of the National Federation of Water Users' Association has taken action whereby THE IRRIGATION AGE is created the official organ of this vast organization, representing 1,000,000 persons on the government irrigation projects.

Concrete Linings for Irrigation Canals

We are presenting in this issue several halftones, with appropriate legends, of concrete linings for irrigation canals. These illustrations are reproduced from a booklet recently issued by the Portland Cement Association of Chicago. We have a lot of other cuts in preparation covering this subject, which will appear in our issues of February, March and April.

Eight Million Acres Released

Eight million acres have recently been eliminated from the National Forest Reserves during the past year, and 1,100 individual tracts within the forest reserves were made available for homestead entry, and the contemplation of these facts produces a sigh of relief and the opinion that all good things come to the man who can afford to wait. We say "afford" advisedly, as in our vision are many instances where if individuals could have secured these concessions some years ago it would have saved them from failure.

Without the Chief Forester's full report no definite knowledge of the areas released or individual tracts made available for homestead entry is at hand, but there is hope that the foolish, short-sighted policy as evidenced by the forest reserve

blanket over part of the Owens Valley in California, whereby some of the wise ones of Los Angeles were financially benefited, is being corrected, but that is another story.

It becomes more evident as time goes on, that the Forestry Bureau is being handled in a fairly clean manner, and there is little likelihood of any further trouble so long as Henry S. Graves is in charge.

More Letters Concerning Congress

In a letter dated December 23rd, from the director of one of the greatest agricultural colleges in the West, the following paragraph appears:

"I have read with interest your editorial comments on the Irrigation Congress. I agree entirely with you in the opinions expressed."

This is one of the many gratifying suggestions with reference to our attitude concerning the Irrigation Congress and Secretary Hooker. It is unfortunate that we are not at liberty to reproduce some of the communications, with names of the writers attached, as the publication of these comments would clearly show that some radical move must be made to bring the Irrigation Congress back to its old-time standing and importance.

It is our opinion that Secretary Hooker would not have been retained in office if some competent

man had entered the list against him. It appears to be merely a case wherein no one cares to take on a purely imaginary responsibility and make an effort to supplant Mr. Hooker with a man of the requisite ability. Anyhow—as they say—this will take place soon, and the Congress, with new blood, should take its old-time position of importance.

**Hayden
Helps
His
State**

Congressman Hayden of Arizona has performed good service for the people of his state in the success of his efforts to secure an appropriation of \$100,000 to complete the diversion dam above Florence. He also obtained \$75,000 to commence the construction of the main canal which will carry the water from this dam to the lands belonging to the Indians and white settlers in Pinal county. His request for \$125,000 to complete the diversion dam near Sacaton was likewise granted. This dam will be constructed with a bridge superstructure, thus providing a much needed means of crossing the Gila river.

This should be good news to Governor Hunt, as, if we remember correctly, this is the point at which his party tried to cross by auto, when their machine was stalled in mid-stream and the dignified governor, with his friends, were compelled to strip and wade ashore, carrying their clothes on their heads.

Simple little affairs like the above often result in great industrial accomplishment, and it is our opinion that the Governor was glad to render every assistance to Congressman Hayden in his efforts to provide not only a good dam, but a safe means of crossing the treacherous Gila as well.

**Suggestions
Leading to
Public
Safety**

State Engineer W. S. McClure of California has made some good suggestions in his annual report to Governor Johnson concerning a law to extend the state's power and give it broader supervision for the protection of the public over the construction of power and irrigation dams.

The suggestion is made that the power of the State Engineer be increased so that his decision will be binding with regard to plans for the formation of irrigation districts. Mr. McClure makes it clear that it should be unlawful to erect a dam unless the plans therefor be approved by the department of engineering, or to maintain a dam that is found to be defective or dangerous until measures satisfactory to the department have been taken to make it safe.

Authority is also asked to keep representatives

of the department present during the time required for construction or repairs.

The AGE has a strong foreboding that opposition to this change will be met with from the representatives of the power companies, but the movement is so clearly for public safety that it should receive hearty support, not only from the law-makers but the public at large.

**Develop
Home
Trade
Also**

In another article in this issue we attempt to show how large sums of money are expended annually in foreign countries in an effort to develop trade for the products of the manufacturers of this country. This plan has met with a reasonable measure of success and results have multiplied since the beginning of the European war.

Work of this character should be prosecuted with unusual vigor at this time so that this country may enter markets heretofore controlled by England, Germany and France, and by opening up new markets for our goods, prove their superiority and thereby lay a foundation and enable us to control important development in this direction in the years to come.

It may, in this connection, be permissible to point in vigorous terms to the conditions in our western country, where a reasonable outlay by manufacturers or the Government may greatly increase the sales of all classes of farm machinery and equipment.

To illustrate, we will take as a base the 90,000 water users under Federal Projects. At a modest estimate the average annual investment of each water user for tools and general farm necessities is \$200; multiply 90,000 by 200 and we have a total expenditure of eighteen millions by this class alone. Add to this the 150,000 irrigation farmers under other systems, private, Carey Act and District projects, and the figures reach a total worthy of consideration by any government or group of producers of material and equipment of the character designated above.

In view of this, one is inspired to question the motive of individuals or Government officials who are laying obstacles in the way of agricultural development thereby restricting the earning and purchasing capacity of these farmers.

The continual nagging of industrious ranchmen and the restrictions and uncertainties imposed by poorly framed laws tend to neutralize a large part of the effort put forth, and furthermore, create a feeling of antagonism toward Government officials where under better laws and conditions a very different situation would obtain.

It is, in our opinion, a vital mistake for officials of the Government to assume the attitude that every settler who complains is trying to get the best of the bargain.

But, to return to the main subject, some definite plan should be adopted by the manufacturers whereby the settlers may be encouraged to greater effort which will increase their earnings, and furthermore, the manufacturers should take such action through their association as will encourage the Government to develop larger areas, and in that way increase the demand for their products.

The eighteen millions annually expended by settlers under Federal projects may easily be increased to one hundred millions.

It is, furthermore, our opinion that the Government should spend a sum annually in developing home trade equal to that put out to secure trade in foreign countries. The AGE will, at an early date, take up this subject with the officials of the National Association of Manufacturers with a view to obtaining the assistance of that body to secure the co-operation of the Government in this movement.

Water-Users the Heaviest Investors The Federal Government is spending millions annually in representation at the various capitals and trade centers of the world to develop business for our merchants and manufacturers, and this money is appropriated by Congress without question or criticism, due to the fact that this work is productive of large returns.

These results are meager compared with what similar expenditures in the upbuilding of our western agricultural possibilities may be made to produce.

This thought comes with particular force when one considers the difficulties encountered by settlers on our newly developed sections under irrigation, and the careless attitude of officials generally.

It perhaps has never occurred to the mind of the ordinary reader that the settlers on the Federal irrigation projects throughout the West are producing, at a low estimate, forty millions in crop values each year as a result of an expenditure by the Government of one hundred millions or less. This sum has constructed works in the form of dams, reservoirs, ditches and their accompanying requirements; and if this work has been properly done this investment has made it possible for 90,000 irrigation farmers to raise crops to the value mentioned. One who studies the situation is inclined to the belief that more money may be profitably expended in this direction and, moreover, teaches

us that these settlers are at least entitled to as good care and attention as are the possible avenues for increasing trade in foreign countries.

These thoughts are brought out by an editorial in a recent issue of the Montrose Enterprise, of Montrose, Colorado, wherein some harsh statements are made about the members of the Board of Governors of the Uncompahgre Water Users' Association, and the pessimism of some of its members in particular. This project, like many others, is confronted with conditions that, to some members of the Board, seem insurmountable. We quote one paragraph herewith:

"From the vehemence in which these pessimistic members of the Board continually express their sentiments, fighting for their pessimistic convictions as though it were a life and death matter, one cannot but give them credit for an honest sincerity in their pessimism. In other words, they are no doubt pessimistic because they honestly believe that they have reasons to feel this way about it."

It is evident that the settlers under this project think that it will be impossible to meet conditions imposed upon them by the Government, and much speculation is indulged in as to the future.

The Enterprise tries to make it clear that the twenty-year payment extension act is evidence that the rules of the Government are not set, in fact, are subject to change, and may be shaped to conform to the needs of the settlers. This writer, who could, without too extravagant conjecture, be classed as a reclamation official, goes on to say that the settlers must not overlook the fact that the Government, being the "largest investor" in the project, is more concerned that the people under this project should make good than the people themselves; and further states that "the whole reclamation proposition is, at least to the extent of the non-interest-bearing feature, a benevolent institution, working directly for the benefit of the settler."

The writer in The Enterprise overlooks the main facts considered at the time of and prior to the passage of the Reclamation Law. For the benefit of the writer in The Enterprise, we quote from Section 4 of that law, as follows: "that said charges shall be determined with a view of returning to the reclamation fund the *estimated* cost of construction of the project and shall be apportioned equitably."

It is the opinion of the AGE that this clause could not have been made clearer, and the settlers cannot be blamed for criticizing an attempt on the part of the Government to so construe the law that it will permit adding to the "estimated cost" a lot of charges beyond and not covered by Section 4 of the Reclamation Act. Furthermore, the AGE

cannot agree with the writer in *The Enterprise* that the Government, being the largest investor, should be more concerned than the 90,000 water users whose labors on the land and expenditure for improvements greatly exceed the total expense so far encountered by the Government.

As an illustration, let us concede that the actual amount of labor performed on each unit (on which the Federal Government holds a first mortgage) during the 14 years since the passage of the Reclamation Law, will average \$1,000 for each settler, not counting help, whether outside labor or that performed by members of the farmer's family. This sum includes a reasonable price per day for team, and outlay for ordinary farm equipment, tools, house, barns, etc., it will thus be seen that this sum multiplied by 90,000 equals \$90,000,000 per year, and that multiplied by 14, the number of years during which this law has been in force, reaches the astounding total of \$1,260,000,000.

On the assumption that our figures are correct, how can it be stated that the Government is the largest investor in these projects, or more concerned

that the great body of men who are working their lives away to bring this property on which Uncle Sam holds a first mortgage to a greater inherent value in the way of labor and improvements, as well as increased productivity, all of which helps in the way of taxation, not only the town, county and state, but the Federal Government as well.

Would it not be well for reclamation officials and publishers to give these facts consideration before criticizing the overworked settler?

Would it not also be well to consider why it is that every request made by the settlers is looked upon as an effort to obtain something to which they are not entitled? Why is Uncle Sam so stingy and critical with the Water Users when he is so freely spending money in other directions, that does not produce one-tenth of the returns? How long will it take the Government to learn that there is something radically wrong in this situation?

The labor employed each year in cultivating lands under Federal projects equals in value the total expenditure by the Government to bring these various districts into existence.

ORLAND PROJECT ENDORSED BY RECLAMATION HEAD

We are presenting herewith matter copied from the *Orland Register*, Orland, Cal., wherein it is shown that the criticisms against that project are not upheld by the head of the Reclamation Service. We quote from the *Register* as follows:

"An answer against which there can be no 'come-back' to all the so-called reports that the Land of Orland is in a bad way financially, that the settlers are unable to meet their payments, their water rents and other obligations, is found in the following letter from A. P. Davis, director and chief engineer of the Reclamation Service.

"Of the 21,000 acres in the Orland project, but eighteen acres remain on which water right applications have not been made, or acceptances of the Extension Act filed. The entire amount of the first building installment has been met without a single delinquency.

"These two facts alone should refute any so-called findings of any expert investigators as to the stability and the financial standing of the people of the Orland project.

"That Director Davis finds that such a fine showing deserves a personal letter to convey his congratulations shows in what regard the officials of the Reclamation Service hold the settlers of the Land of Orland."

Department of the Interior,
United States Reclamation Service.
Washington, D. C.

December 16, 1916.

Orland, California.
Project Manager,

I note by your monthly report for November that at the expiration of six months from the date of the issue

of public notice on the Orland Project there remained but eighteen acres of the entire project area upon which water right application had not been made, or acceptance of the Extension Act filed. I note, furthermore, that on December first the water users' association paid to the local fiscal agent the entire amount of the first building installment.

Please convey to the officers and members of the water users' association the heartiest thanks of the Reclamation Service for the promptness and completeness with which they have met their obligations, and appreciation of the co-operation which has always been extended by the Orland Project.

Also express my wish for the New Year that the prosperity of the Orland Project and the water users thereunder will always be as striking and complete as their co-operative spirit promises and deserves.

A. P. DAVIS,
Director and Chief Engineer.

A NEW YEAR'S GREETING

From the First Assistant Secretary of the
Interior, January Number Recla-
mation Record

To the Farmers on All Our Projects:

The world knows no greater blessing than opportunity to do a man's work in peace, somewhere. There is no higher or more patriotic duty than to do it well. There are many who have no chance, but you farmers on the projects and we in the Washington work have our chance. Let us all have pride in our jobs and let us do them man fashion.

ALEXANDER T. VOGELSANG.

LAND CLASSIFICATION GIVES NATIONAL FORESTS PERMANENCE

As a result of land classification work, more than eight million acres were eliminated from the National Forests in the last fiscal year and, in addition, over 1,100 individual tracts within the forests were made available for homestead entry, according to the annual report of Henry S. Graves, chief of the forest service, which emphasizes the necessarily permanent

character of the National Forests, and points out the importance of definitely determining the status of the land which the forests contain.

"The National Forests," says Mr. Graves, "are gaining in stability through the land classification work. It is important for the general public to know what lands are to be retained permanently by the Government, and what lands will be available for agricultural settlement. The whole forest enterprise is based on the assumption of permanence. All the work is conducted with a view to constructive development of the property and its constantly increasing usefulness.

"Every timber sale is made with a view to future consequences. The work of protection from fire is not only to prevent the destruction of standing timber, but to save young growth and encourage the natural reproduction of lands which have been injured by previous abuse. Millions of trees are established each year which will not come to maturity for a very long time. A regulated system of grazing looks to the upbuilding of the Forest range, as well as to its present use, and the investment of public funds in extensive improvements is predicated on the permanence of the Government enterprise.

The need for consolidating land ownership where government and private lands are interlocked is pointed out by Mr. Graves. Congress has, he states, already authorized an exchange of lands on the Florida, the Oregon and the Whitman National forests. Under the same policy exchanges have been or are being negotiated with South Dakota, Montana, Idaho and Washington for school lands in the National Forests located in those states. The consummation of three of these exchanges now awaits final approval by Congress.



Concrete Lined Canal, Garden City, Kansas, Irrigation Project.

Other measures which will have a far-reaching significance in relation to the permanence of the National forests, says the report, are the appropriation by Congress at its last session of ten million dollars for the construction of roads within the forests and that of three million dollars to extend the National Forests in the eastern mountains by purchase. "The ap-

propriation for the construction of roads will permit the opening up of regions heretofore inaccessible, will greatly increase the use of the resources in the forests, will shorten lines of travel across the states and between communities, will stimulate prospecting and mining in mineral regions and will aid community upbuilding.

"The importance of having public forests at the headwaters of important streams has been recognized and greatly emphasized through the appropriation of \$3,000,000 for continued purchases of lands begun under the so-called Weeks law. The work of establishing these forests has been started under the most favorable auspices, and its discontinuance would have been peculiarly unfortunate. With the new appropriation the purchases may now go forward with a view to blocking out and extending the various units."

14,908,127 ACRES OF LAND OPEN TO HOMESTEADERS

There are 14,908,127 acres of government land open to homestead entry, of which about 4,000,000 is suitable for cultivation. Perhaps a somewhat larger amount is valuable for grazing purposes, and 6,000,000 acres, including some of the agricultural and grazing land, is mineralized. A large acreage of government land yet open to entry is underlain with coal. For further information address Irrigation Age.

ALFALFA GROWING IN CANADA

An Address Delivered by Mr. Don H. Bark, at the Ninth Annual Convention of the Western Canada Irrigation Association, at Bassano, Alberta.

Alfalfa has now been grown successfully throughout Alberta for a sufficient number of years so that it may be said to have passed the experimental stage. There is no doubt but that it now occupies a permanent place among the staple forage crops of the province. This plant is easily the King of forage plants, for no other forage contains so many essentials of merit. It not only excels all other forage plants both in yield and in feeding value, but also in its beneficial effect on the soil. Alfalfa produces more food value for less cost than any other crop we can raise. Indeed, too much can hardly be said in praise of this wonderful plant and if history repeats itself, the time is not far distant when it will become the predominating crop on every irrigated farm in the province. As one of the great benefits secured from alfalfa is its great improvement in the fertility of the soil, it seems well in discussing the subject to deal for a moment with the fundamental principles of soil fertility, in order to show more clearly the beneficial influence of alfalfa upon our arid soils.

Principles of Soil Fertility

Of the many elements found in the soil, four only are used to any considerable extent by the plants. These four are nitrogen, potash, phosphoric acid and lime. Nitrogen itself is a gas and forms a large part of the air we breathe, but plants can not utilize it in this form. It must be combined with other elements in the form of a salt (nitrate) before it becomes available as a plant food. The last three mentioned plant foods are minerals formed by the breaking up and decomposition of the parent rock, of which the soil was originally formed. These four substances are the principal or most important of the plant foods. Crops not only need far more of them than all the rest, but good yields cannot be produced upon any soil in which one or more of these elements are either deficient or entirely lacking. The plants obtain these substances from the soil in solution in the water absorbed by the plant roots. Only such of these elements or compounds therefore as are soluble in water are for the time being available as plant foods, for the plants can neither absorb solid particles of plant food into their roots nor could they utilize them in this shape if they could.

All soil is primarily decomposed rock, the particles of which it is composed varying in size and fineness from the coarsest gravel to particles so small that sometimes forty thousand would have to be laid side by side to make an inch. Soils as we commonly know them, however, are more or less mixed with vegetable matter in various stages of decomposition. This decomposed vegetable matter is commonly called humus, and is the principal source of that most important plant food, nitrogen, the mineral plant food being derived from the parent rock. Now let us stop for a moment to note the difference between the soils of a humid country and of an arid or semi-arid one. The rains of centuries in the humid belt have caused a luxuriant vegeta-

tion to grow, which dying down each year, has added a world of humus and nitrogen to these soils, but these same rains have meanwhile leached out enormous amounts of soluble mineral plant foods. The soils of humid countries are therefore rich in humus and nitrogen, but comparatively poor in the mineral plant food, while the soils of arid and semi-arid countries are almost diametrically opposite, for it has never rained sufficiently to either grow the luxuriant vegetation or to leach out the mineral plant foods. The soils of the arid and semi-arid regions are therefore rich in mineral plant foods, for they still have all that was originally contained in the parent rock, but they are quite liable to be deficient in nitrogen. It can be seen therefore that whenever the eastern or humid soils becomes worn out or run down, the addition of mineral plant foods is necessary. This can only be accomplished by the purchase and application of expensive commercial fertilizers. Arid and semi-arid soils, however, rarely need the addition of such fertilizers, for they have more mineral plant foods than the humid soils had a million years ago, but their supply of nitrogen and humus is normally only sufficient to last for but a few crops, when it must needs be replenished. And we are indeed fortunate that this can be so easily and cheaply done through the growing of that valuable plant alfalfa.

If we take pains to keep up the supply of nitrogen in our soil, we are far better off on an irrigated farm in Alberta than any one can ever possibly be on a farm in the humid belt, for with our soil far richer in the necessary plant foods, with our longer days of sunshine, and our ability to control the supply of moisture to the crops, giving them just what they need, and, above, all, when they need it, we can always grow larger crops and secure larger profits than can be secured anywhere in the humid belt, for the farmers in this belt have neither the rich soil, the same amount of sunshine, nor the ability to control the amount of moisture in the soil, which is so necessary to maximum crop production. We must, however, grow alfalfa, for as I shall explain later on, it adds more nitrogen to the soil than any other crop we can grow.

The Type of Soil Required

Alfalfa has been known to grow and do well on a very large variety of soils. It, however, has its preference, and usually does better on the lighter soils consisting of the sandy loam and clay loam. Even in districts having the heavier soils most farms contain one or more classes of soil, and in such cases the alfalfa should be planted on the lighter or more sandy soil. I should not hesitate, however, in planting alfalfa even though my farm consisted of all heavy soil. The one thing that alfalfa will not stand is wet, soggy soil. Though it requires considerable precipitation or irrigation water throughout the season, it prefers a well drained soil. If those desirous of planting alfalfa upon heavy soils will select the higher and better drained portions of their farm for this crop, but little difficulty will

usually be experienced. Never plant alfalfa in the bottom of a depression that does not have surface drainage.

Preparation of Ground for Irrigation

There are two types of irrigation systems adapted to alfalfa in this province, namely,—free flooding and flooding between borders, though the furrow or corrugation system might be used to some advantage in certain districts. Free flooding consists of flooding water between more or less parallel head ditches, spaced from fifty to two hundred feet apart. With this system, as with all others, if efficient irrigation is desired, all knolls and depressions must be removed, so that water can run uninterruptedly without pooling up from one head ditch to the next one below it. The larger knolls and depressions should be smoothed off with a Fresno scraper, as this tool, where the haul is short, will move quicker and cheaper than any other implement in common use. After the larger knolls and depressions have been smoothed off with a scraper, a rectangular leveller, with which you all should be familiar, should be run over the ground, both lengthwise and crosswise of the field.

The head ditches with free flooding should be run on a uniform of grade of from one-tenth to three-tenths of a foot fall per hundred feet. They should be installed more or less parallel to one another, the proper distance between them depending somewhat upon the topography and nature of the soil. From fifty to two hundred feet apart has been found to be the proper spacing for this section. One ditch should be used at a time for the irrigation, the water being dammed up at frequent intervals by canvas dams, and turned out into the field through notches cut with the shovel in the lower ditch bank by the irrigator. If the levelling has been carefully done, and the irrigator gives the water careful attention, very efficient irrigation can be accomplished by this system. There should not be much waste water, but whatever water that is wasted should be caught up in the next ditch below and used for the irrigation of the next strip.

Flooding Between Borders

This system is probably best adapted for alfalfa on practically all of the various types of soil found in the province.

So far as topography is concerned, it can be used on all but the steeper grades, approximately one hundred feet per mile being the maximum slope with which it should be used for alfalfa. The head ditches with this system are constructed in about the same manner and about the same or a little greater distance apart as with the free flooding system. The only essential difference between this system and the free flooding system is that more or less parallel border guiding dykes are constructed 30 to 60 feet apart between the head ditches, and more or less at right angles to them. The water is checked up in the ditch with canvas dams as before, and is flooded between the border guiding dykes to the next head ditch below, the dykes guiding and controlling the water in a much more efficient manner than with the free flooding, where the water is unconfined, and requires careful attention from the irrigator. To be ideally laid out for irrigation by

this system the side fall should be taken out of each strip—in other words it should be made approximately level crosswise throughout its length. It is not necessary, however, to make the lengthwise slope uniform, it simply being necessary, the same as with the free flooding system, to smooth off the knolls and depressions sufficiently so that water may run interruptedly from one head ditch to the next one below. In actual practice where the land is not too steep these parallel border guiding dykes usually run down the greatest slope, for this is the direction the water will naturally run with the least attention. There will also be less side fall in each strip than as if the border dykes angled down the slope. The dykes are usually constructed at the time the levelling is done, the dirt being deposited on the location of the dykes by the Fresno. Where but little Fresno work is necessary the dykes are made by ploughing a back furrow consisting of two or four furrows on the proposed location of each dyke. The dykes are afterwards gone over by a ridger, which is run lengthwise of the back furrow. This ridger consists essentially of two 2x12 planks, 16 to 18 feet long, placed on edge with a spread in front of from 12 to 14 feet and only approximately 3 feet behind. The wide end is pulled ahead, thus gathering a shallow layer of dirt from quite a wide area on each side of the back furrow, the dirt being pulled against the side of the back furrow by the sloping sides of the ridger. These ridges are afterwards smoothed down and rounded over by harrowing them lightly, the alfalfa being planted across the top of the ridges in the same way and at the same rate as between. If these ridges are constructed in this manner they will be high enough to control the water, yet broad and low enough so that alfalfa will grow on the tops of them, and the wagons and hay tools can cross them with no inconvenience whatever. The ridges when completed should be from 6 to 9 inches high in the center and from 2 to 3 feet broad at the base.

In practice the water is turned into the head of each strip at two or more places and spreads quite uniformly between the two guiding dykes, as it advances across the strip. The irrigator should cut it off and turn it into the next strip below as soon as the water has advanced far enough so that the quantity in the strip will advance to the lower end and thoroughly irrigate the bottom portion.

This system is a very efficient one, for not only alfalfa but all other grasses, and provided the ground is properly prepared for it at the start, will be found that the water will actually require less attention and that more acres can be irrigated in a day with less work than by means of any other system.

Preparation of Seed Bed

The preparation of a proper seed bed for alfalfa is very important. Alfalfa has a small seed, and the plant for the first two or three months is rather weak and puny. It, therefore, requires a well cultivated seed bed, for a good stand cannot be secured if it is planted in rough, cloddy ground. Alfalfa plants are quite spindling and grow so slowly during the first two or three months of their growth that the weeds in a very weedy field will sometimes either entirely crowd out the alfalfa or be the means of

securing a very thin stand. It is best, therefore, to plant alfalfa on a tract of land that is as free from weeds as possible. Land that has been summer-fallowed the previous year, or that has produced potatoes or other rowed crops is best adapted for alfalfa, as it will be the freest from weeds. Grain land that is fairly free from weeds is also well adapted for alfalfa, provided it has been in cultivation long enough to disintegrate the sod. Do not plant alfalfa on new breaking, as the prairie and other grasses will not let the alfalfa secure a good quick start.

Inoculation

As was mentioned in the introduction, alfalfa has the power of supplying nitrogen to the soil, and it is a good thing Providence provided this plant with this power, for if it did not have it there would be but few soils sufficiently rich in nitrogen to grow the crop for any length of time. This same thing would probably hold true to a somewhat lesser extent with the other leguminous crops, for they all contain a large amount of nitrogen or protein. They, therefore, must be able to secure a large amount of it from the soil. The manner in which alfalfa and the other legumes supply nitrogen to the soil is through the bacteria which live in and upon their roots. These bacteria are not originally present in all soils, for these particular bacteria cannot live without legumes, nor can the legumes live for any length of time without the bacteria, the principal reason being that the legume is such a greedy feeder upon the nitrogen in the soil that unless the bacteria are present, it soon exhausts the available nitrogen in almost any soil. While all legumes harbour bacteria of much the same nature, it has been found that there are certain kinds that prefer each particular leguminous plant. This is probably due to the fact that these particular bacteria have adapted themselves to this plant. These bacteria are so small that they can scarcely be seen with even a microscope of the highest power. It is believed that they are absorbed by the minute root hairs along with the water, and after being absorbed irritate the roots to such an extent that plant juices are automatically thrown out at the spot, thus forming the little appendages called nodules in which the bacteria live. These nodules vary with alfalfa from small whitish lobes the size of a pin head to clusters of these lobes one-half inch in diameter arranged somewhat like a bunch of grapes. These bacteria after becoming domiciled in the nodules attached to the roots multiply at an extremely rapid rate, and are able to absorb the free nitrogen found in the air spaces of the soil, and work it over into nitrates, a definite chemical compound and a plant food of the highest value, in which shape the alfalfa itself or any other plant can utilize it. These bacteria, therefore, are very essential to alfalfa, no matter where it is grown. In the soils of certain districts throughout the west it seems there are enough of these alfalfa bacteria or other bacteria of a similar nature that can readily adapt themselves to the alfalfa plant, so that it is unnecessary to inoculate the alfalfa at the time of planting. Such is not the case here, however, though the continued planting of alfalfa on our irrigation projects may in time develop these bacteria so that they will become so widely scattered

throughout the soil that it will be found unnecessary to supply them artificially.

The best method found to date of supplying these bacteria to our alfalfa fields is to secure surface soil to a depth of nine or twelve inches from an old, well-established alfalfa field that has become well inoculated, and to scatter this soil evenly at the rate of from 200 to 400 pounds per acre upon the field after it has been prepared for alfalfa, and immediately before seeding. Failure to do this and take the proper precautions after it has been done has probably been the cause of a greater number of failures with alfalfa in this part of Alberta than all other causes taken together. These bacteria can stand very low temperatures, even 20 or 30 degrees below zero will not kill them, but either bright sunlight for a few moments or a continued temperature for a few hours of 100 or more degrees Fahrenheit will kill them very readily. It is, therefore, very necessary to secure the original soil in a fresh condition, to keep it in a comparatively cool place free from sunlight and to spread it promptly and evenly upon the field to be planted, after which it should be immediately harrowed in so as to cover the bacteria deep enough and quick enough so that they cannot be killed by sunlight. If these precautions are taken, but little trouble will be experienced with the soil transfer method of inoculation.

There is one other method of inoculation that is coming into quite general use. This is inoculation by pure cultures, which are purchased from laboratories which make a business of growing and preparing these cultures for this use. These cultures cost from one to five dollars per acre, are put up by the laboratories, and delivered to the consumer in small bottles, each bottle containing millions of the proper kind of bacteria. The directions for using these cultures differ slightly, but should be strictly followed. They usually state that the contents of the bottle should be emptied into a gallon of water that has previously been boiled and cooled, to which is added a little sugar or beef broth, after which the mixture is placed for forty-eight hours in a moderately warm place to enable the bacteria to grow and multiply, about the same as a house-wife sets her yeast. After these bacteria have been developed a little more water is added, after which the alfalfa seed itself is thoroughly sprinkled with the solution containing the bacteria. The seeds are then allowed to dry in a moderately cool, dark place, after which they should be immediately planted. If the culture is good when secured and directions are followed out, a sufficient number of bacteria are usually attached to the alfalfa seed to thoroughly inoculate the whole field. After the small plants start to grow the bacteria are absorbed by the roots, and the process previously described is carried out, the bacteria not only furnishing sufficient nitrogen in an available form for the growth of the plant, but an excess supply for the crops which will follow, after the alfalfa is plowed up.

The soil transfer method of inoculation where soil free from weeds can be secured is, however, probably the cheapest, surest and best method for the farmers of this section, and if directions are carefully carried out there will be but few failures. The principal precautions that are necessary are (1) to

procure fresh soil from a field that you are sure is well inoculated, (2) to apply it immediately, and (3) harrow it in without delay.

When alfalfa is well inoculated it will be noticed that the plants are vigorous and of a dark color, while the plants not inoculated are liable to be spindling and of a light or yellowish green color. The lack of inoculation, however, should be determined by a careful examination of the roots for nodules, as too much soil moisture also causes alfalfa to be light or yellowish green in color. The inoculation frequently takes well only on a portion of the field. If these spots are well scattered over the field they will probably spread over the entire area during the second year. If they show up only on part of the field it would be well the second spring to put more inoculated soil on that portion about the time the plant starts to grow, and to disc it in lightly at once. Irrigation water spreads the inoculation much better than rainfall, as some of the bacteria seem to be carried in suspension in the water. Some have inoculated their fields by spreading a strip of inoculated dirt below the ditch and irrigating immediately the water carrying sufficient bacteria from this dirt to inoculate the field. This method is not recommended, however, except during the second year, and then only in cases where the inoculation hasn't become well established from the original inoculation.

Time of Planting

A study of the rainfall records of this section shows that there is usually sufficient rain during May and June to start alfalfa, and these are the best months to start it, not only because of the rainfall, but as the plants are not particularly hardy until they attain a height of at least six inches, it is desirable to secure as much growth as possible before winter sets in. It is considered of considerable advantage to have rainfall enough to start the alfalfa, for the seeds are so small that if one were compelled to irrigate freshly harrowed soil to start the seeds, some of them would be bound to be washed away. This section is especially fortunate in this regard, for in most alfalfa growing districts it is necessary to irrigate the seed up.

Variety of Seed

Though there are between 50 and 100 species of alfalfa, not over six of these are of much economic importance and these are all much alike. The chief difference between the American varieties is in hardiness or ability to resist cold winters, the two best strains for this locality probably being Grimm and Turkestan. Both of these strains have done very well here and should be recommended for planting, though almost any northern grown Montana seed should give good results.

Rate of Seeding

Alfalfa seeds are quite small but usually have very good vitality. It has been found by actual count that if ten pounds of seed are scattered uniformly over an acre, fifty-two seeds would be placed upon each and every square foot. As it is indeed a poor farmer who cannot make at least half the seeds planted grow, it can be seen that planting at the rate of twenty pounds per acre is unnecessary, for this

would put one hundred and four seeds upon every square foot or nearly one to each square inch. From carefully conducted experiments on a Government Experiment station in southern Idaho, where all conditions were ideal, including a very fine seed bed, it was found there was no difference in the yield during a three-year period from alfalfa seeded at the rate of 4, 8, 12, 16 and 20 pounds per acre. It is not possible nor practicable, however, for the farmer to manufacture such a good seed bed upon large areas, as was secured on this Government Experiment station, and it is, therefore, recommended that from 12 to 20 pounds and no more of good alfalfa seed be planted. Do not make the mistake of planting too deep. Alfalfa seed is small and cannot, like peas, wheat or potatoes, come up through three or four inches of soil. During fairly moist weather one-half inch in depth is sufficient, while in drier weather from one to one and a half inches would be somewhat better. Do not plant alfalfa deeper than one and one-half inches. It does not matter much whether alfalfa be planted in drills or whether it be sown broadcast, so long as the proper distribution and depth of planting is secured. In planting it broadcast on top of well prepared ground, a fairly light harrowing after seeding usually places most of the seeds at about the right depth. Drilling the seed is probably preferable in this section, for if careful attention is given to the drill all of the seeds may be placed at the proper depth.

Nurse Crop

There is no question but that a better stand of hardier alfalfa will be secured if it is planted alone, without a nurse crop. Alfalfa prefers lots of sun, which cannot be secured when it is planted with oats, wheat or barley. There is no possible advantage in planting a nurse crop with alfalfa, except that a year's use of the ground is not lost. Taking the extra hardiness of the plant and the thicker stand that is secured without a nurse crop into consideration, however, it is hardly probable that it will pay in the long run to plant alfalfa with a nurse crop.

If alfalfa is intended as hay for either hogs or cattle or a pasture for hogs, it is preferable to plant it alone. It is, however, much improved as a horse hay, both in yield and feeding value if some other grass is planted with it. A grass to form the best mixture with alfalfa should do well in the shade, mature at about the same time as the alfalfa, and be comparatively rich in carbo-hydrates, instead of protein, in order to form a more nearly balanced ration. The very best grass that can be planted with alfalfa to accomplish this purpose is orchard grass. It is perfectly hardy in this climate, it does well in the shade, matures more nearly at the same time as the alfalfa than any other grass, is relished by stock, and has a good feeding value. Liverymen that have once fed this type of hay to their horses will pay from \$1 to \$2 per ton more for it than straight alfalfa. Where orchard grass will grow and do as well as it does here, never plant timothy as a mixture with alfalfa.

Irrigation of Alfalfa

The irrigation of alfalfa or any other plant is easy and simple, providing the land is sufficiently

and properly prepared at the outset. Too much emphasis can hardly be placed upon the preparation of the land for the irrigation of alfalfa. Water cannot be made to run up hill, and it is absolutely imperative if good success is to be obtained with alfalfa that all knolls and hollows be so levelled down at the outset before the alfalfa is planted that the water can be made to run uninterruptedly from one head ditch to the next one below it. There is much more reason for careful levelling of the ground before planting alfalfa, pasture or other permanent crops, than there is with grain, for the same trouble will be experienced with every little hill and hollow every time the alfalfa is irrigated every year, while where grain is planted there is an additional opportunity of doing more levelling on the land each spring.

When to Irrigate Alfalfa

Careful experiments have been made during the past few years to determine at what stage of growth alfalfa needs irrigation, and it has been found that it needs a practically constant uniform supply of moisture throughout the season.

This condition can only be brought about where irrigation is possible, yet owing to the variation in the precipitation in this section, no hard and fast rule can be laid down, either as to the number of irrigations required or the stage of growth at which they should be applied. Much will depend upon the type of soil and the amount of rainfall received during the season. Every irrigator should learn to study the needs of his own particular soil and crops, and then apply his irrigation water at such times and in such amounts as will maintain the necessary constant uniform moisture supply in the soil. Alfalfa should never be allowed to become too dry, and above all, water should never be allowed to stand on it during irrigation for over twelve hours at a time. Neither should it go into winter quarters in a very wet, muddy condition, as winter killing may result. During normal years in this section alfalfa will probably require from two to three irrigations during the season.

Amount of Water Required

Alfalfa is a gross feeder, and grows luxuriantly throughout the season, there being a very large amount of leaf surface exposed to the sun and wind, from which an unusual amount of transpiration takes place. Alfalfa, therefore, requires considerably more water than almost any other crop we can produce, all other conditions being uniform. A long series of careful, exhaustive experiments were conducted under my supervision by the United States Government for this purpose, and demonstrated that where all other conditions are similar, alfalfa requires twice as much irrigation water during a season as grain. Where grain does best with one acre-foot per acre, alfalfa requires two acre-feet, and where grain requires one and one-half acre-feet, alfalfa requires three feet, and has a tendency to produce the most crop where the most water is supplied, though care must be used not to over-saturate or waterlog the soil, for alfalfa will not stand "wet feet."

Time to Cut

Alfalfa is pre-eminently adapted as a hay crop, for no other forage recuperates so quickly after cut-

ting. Parts of southern Arizona and the Imperial Valley, California, cut alfalfa as often as nine times a year. In order to secure the largest possible crop of the highest possible feeding value, however, alfalfa must be cut at the proper stage. This is at the time that the little basal shoots or the sprouts of the next crop start, which is usually when the crop is about one-tenth in bloom. If the crop is left until one-half or in full bloom these basal shoots will have grown so long that the mower will clip their tops, thus retarding the start of the second crop, while if it is cut at the proper time just as their basal shoots start up around the crowns near the ground, the next crop will come on and begin growth immediately, provided the necessary amount of moisture is available in the soil at the time.

General Treatment, First and Succeeding Years

There is insufficient time and space at my disposal to make a general discussion of alfalfa in all its phases. These other phases will be taken up by other papers. I wish, however, to dwell slightly on the general treatment of alfalfa. After planting alfalfa, there is nothing to be done with it until it is from six to ten inches high, except to see that it has the proper supply of moisture. At from six to ten inches in height, no matter whether the field is weedy or not, it should be clipped in order to strengthen the crowns and thicken up the growth. If the season has been favorable enough and the initial planting early, there may yet be time to secure one crop during that season, though in the majority of cases even in much milder climates no crop at all is expected the first year. Mr. H. Lausen of Carseland during the past season has secured about as large a yield from alfalfa for the first season as I have ever seen, even in the mild climates of Colorado, Utah or Idaho. Mr. Lausen planted two acres during the latter part of May, 1915, and in August harvested one and one-third tons of cured hay per acre from the plot. This I consider to be phenomenal. If the initial planting of alfalfa has been done so late in the season that clipping when it has reached from six to ten inches in height will force it to go into winter quarters with less than four inches of growth, I would not clip it the first year at all, for alfalfa, in order to be able to withstand the winter in the best possible shape, should have some amount of growth at the time the ground freezes up. This holds particularly true for the first season. In the subsequent years alfalfa requires no unusual treatment, except that care must be used that it has a proper supply of moisture, that water does not stand upon it, and that the crops are cut and cured properly. Discing and loosening up of the surface each spring, after about the third year, has been found to be beneficial in many localities, particularly if weeds or grass have a tendency to creep in. Under these conditions discing every spring will be advised here.

Hardiness and Vitality of Alfalfa

There is no doubt in regard to the hardiness and long life of the alfalfa plant in this section. If planted on the proper class of well-drained soil it will positively do as well here as in any similar climate on earth. It has been my pleasure during

the past season to find alfalfa stems seven feet nine inches in length, and to dig five roots of alfalfa that totalled seven feet across the crowns when hung side by side. Neither southern California nor Asia herself, the original home of alfalfa, can beat this, so have no fear in regard to the strength and hardness of alfalfa grown in this part of Alberta.

Conclusion

Before closing I wish to again emphasize the following facts:

1. That alfalfa growing is no experiment in this part of Alberta.
2. That alfalfa has a greater food value and produces more of it at less cost than any other forage that can be raised in this section.
3. That there is no other crop that will improve one's soil so much as the growing of alfalfa. It has been known to double and even treble the yield of cereals after having been grown for but three years.
4. That the lighter soils are best adapted to alfalfa and that only well-drained soils should be selected for this crop.
5. That ground planted to alfalfa should be carefully prepared for irrigation—that money spent on levelling pays larger returns on the investment than the expenditure of any other like amount.
6. That alfalfa seeds are so small that the manufacture of a finely pulverized seed bed is absolutely imperative if good results are to be secured.
7. That alfalfa ground must be inoculated in

this section; that soil transfer is probably the preferable method; and that great pains must be used in securing fresh soil, in spreading it evenly, and in harrowing it in immediately if good results are to be secured.

8. That from 12 to 15 pounds of seed per acre planted not over 1½ inches in depth is proper.

9. That planting without a nurse crop will give better success nine times out of ten and be more profitable than planting with a nurse crop.

10. That alfalfa requires more water than grain, and that the soil should have a uniform moisture content from early spring until late fall.

11. That alfalfa should be clipped the first year about the time it reaches 6 to 10 inches in height.

12. That the crops should be cut whenever the basal shoots or the beginning of the next crop's growth starts, which is when approximately one-tenth of the crop is in bloom.

13. That alfalfa should be disced every spring after the second year, particularly if weeds and grass have begun to grow with the crop. This not only kills the weeds and grass, but actually causes the alfalfa to become thicker on the ground.

14. That alfalfa has a broader use, and is more profitable and more certain than any other crop that can be raised in this district, and that when alfalfa is once planted on a farm and given a fair trial not only as a horse feed, a cattle feed and a pig pasture, but as a soil rejuvenator, that this farmer will never again be willing to farm without an alfalfa field on any irrigation project in Sunny Southern Alberta.

ARTESIAN WATER FOR IRRIGATION IN LITTLE BITTERROOT VALLEY, MONT.

Little Bitterroot Valley, Mont., which lies within the former Flathead Indian Reservation, and includes an undeveloped unit of the Flathead project of the United States Reclamation Service, has recently attracted attention on account of the artesian water that has been discovered in it, some of which is of notably high temperature.

The valley was opened to white settlers in 1910 and now has a considerable population. In 1911 a well drilled on the farm of Dr. A. H. Brown struck flowing water, and flows were afterward obtained at several other places. By August 1, 1915, about 40 wells had been drilled, of which 17 were flowing. The United States Geological Survey, Department of the Interior, has investigated the artesian water supply in order to determine to what extent it can be used for irrigation in connection with the surface waters. Mr. O. E. Meinzer, a geologist of the Survey, made a thorough study of the valley, gathering well data, measuring the discharge of the flowing wells, and collecting samples of the well water. Mr. Meinzer's report of this investigation, which has just been published, includes the following significant statements:

Artesian supplies can be obtained on the bottom lands in considerable quantities at low cost, but on the higher lands, in only small quantities

and at very high cost for irrigation. The artesian supply is securely stored underground, where it can be preserved from year to year and can be drawn upon whenever desired. In this respect it has an important advantage over surface supplies, which can not be stored indefinitely. Instead of being used lavishly all the time, it ought to be regarded as the ultimate reserve, to be drawn upon only when there is a shortage in the surface water supply. Thus in years of considerable rainfall or when the supply of surface water is ample the flowing wells should be kept closed and allowed to recuperate, and in exceptionally dry years, when the supplies of surface water are inadequate, the artesian water may be heavily drawn upon. The report calls attention to the necessity of casing wells properly with heavy pipe and of securely plugging abandoned wells, for the leakage from a few defective or abandoned wells at low levels may practically ruin a small artesian basin, such as the one in the Little Bitterroot Valley. The report concludes with specific recommendations as to the developments that should be made and gives data on the cost of such developments.

Copies of this report, which is issued as Water-Supply Paper 400-B, can be obtained by applying to the Director, United States Geological Survey, Washington, D. C.

NEWS NOTES FROM IRRIGATION PROJECTS OF THE COUNTRY

California

Examiner Myron Westover of the railroad commission presided recently at the hearing of the application of E. J. Hopson for leave to exercise a franchise to operate an irrigation system in Shasta county. If Mr. Hopson's plan receives the approval of the commission he will erect a dam on the north fork of Cow Creek and operate the Cow Creek irrigation canal with a flow of 40 feet of water per second. This water will be conducted by the canal to Stillwater plains, which lie two miles from Anderson and about six miles east of Redding. The water from the canal will be used to irrigate 3,000 acres, which is to be planted in fruit and alfalfa.

Owing to the increased acreage of rice in Glenn county, a movement has been started for the enlargement of the Central Irrigation Canal, the demand for water for next year being larger than ever before.

The Cheney Slough Irrigation Company, having holdings near Colusa, will plant 6,000 acres to rice and 4,000 acres to beets in 1917.

Men prominent in the organization or irrigation districts and engineering work met in Dixon recently to discuss the proposed irrigation district to be organized in that section of Solano county. It is proposed to build a large storage reservoir in the Putah Creek canyon to furnish water for the irrigation of 20,000 acres. Farmers have already signed up over 10,000 acres. A gravity system of irrigation is strongly favored by the small farmers, who are put to a great expense pumping, but the grain farmers are not enthusiastic for irrigation, and this meeting was held with the hope that the arguments advanced would show the advantages that all will receive from the formation of a district.

Following differences between James Willison, contractor, and the directors of the Anderson-Cottonwood Irrigation District, all construction work on the project was suspended recently, and three hundred men employed in the construction of the ditches quit, stating that they have not received their pay. Contractor Willison claims that the district owes him \$40,000 in back payments for the work already completed, but this is denied by the directors of the district. Charges to the effect that the \$480,000 bond issue has been entirely exhausted are also denied by the directors, who claim that \$110,000 is still on hand with which to complete the project. The Anderson-Cottonwood project is the largest irrigation enterprise under way in the state north of Glenn county.

Colorado

A meeting of the stockholders of the Welton Ditch Company, which irrigates lands in Orchard Park, was held in the offices of the Pueblo Land and Irrigation Company recently. The meeting was for the purpose of considering means of purchasing more water rights to better the irrigation possibilities in the district.

At the annual election of the Greeley-Poudre Irrigation District, held recently at the various voting precincts for the election of one director for District No. 2 to serve three years, there was no contest and Dr. J. N. Agan of Pierce was elected unanimously.

The Redlands Power and Irrigation Company has filed suit in district court for \$18,225 against Harold Ford Platt, formerly of Grand Junction, but now a resident of Lansing, Mich. To the principal sum is added interest at 8 per cent, since 1912, making a suit of approximately \$25,000, when costs are added. The plaintiff declares the defendant had title to 192 acres of land on the Redlands in 1910 and that a contract was made to provide for the construction of canals and presentation of water rights, which the Redlands company completed as per agreement. They claim that Platt paid a small sum, \$975, and no more.

After having served the Loveland irrigation system for fifteen years as president, W. C. Levis has announced that he will retire at the annual meeting of the directors early in January. When the Greeley-Loveland people purchased the present reservoir and ditch system from the old English company fifteen years ago, Mr. Levis was made president of the company and has been reelected at each succeeding annual meeting since. Since Mr. Levis has had the management of the company, Lake Loveland, the reservoir of the system, has been greatly improved; the two ditches out of the Thompson river, known as the Bowers ditch, which fills the reservoir, and the Greeley-Loveland ditch, that carries water to the farms, have been improved by cement linings in many cases. Practically all of the eighty-five or more old wooden headgates that were on the line of ditches have been replaced by cement and steel structures.

Idaho

At the election of the Emmett Irrigation District recently E. J. Reynolds of Emmett was reelected director for a term of three years. Considerable importance was attached to this election in view of the ouster proceedings recently filed against Mr. Reynolds. The vote is taken as an endorsement of the plans of the directors, and the work of enlarging the

Emmett irrigation canal will be continued.

Through construction of a new ditch and pumping plant now being erected, between 1,000 and 1,200 acres of fine bench land tributary to Eagle is to be brought under irrigation. The project is being promoted by Nellie M. Wise. Through a contract recently obtained with the Farmers' Union Canal Company, the new project is to receive water through its main canal. At a point one and a half miles north of Eagle a diversion ditch is being run northward about 500 feet. There a reservoir is being located, and it is here that the pumping plant is being installed. By means of these pumps it is planned to raise the water between seventy and eighty feet. It will be delivered to a canal, which will distribute the supply westward a distance of two miles, reclaiming approximately 1,200 acres of valuable south slope lands lying between Dry Creek and Pleasant View. The system will be completed in time for delivery of water next spring.

Deeds were filed at Lewiston late in December for the sale by the Lewiston-Clarkston Improvement Company of its electric power plants and irrigation systems to the Washington-Idaho Water, Light and Power Company. The latter company was recently organized by Liggett, Hichborn & Co., of New York and Boston. The consideration of the sale was \$800,000. With the filing of the deeds a bond mortgage in favor of the Equitable Trust Company of New York was also placed on record, which authorizes a present bond issue of \$600,000 and a future issue of \$4,400,000 to meet future developments.

At a meeting of the State Land Board held late in December the board rescinded its action cancelling the contract of the West End Twin Falls Irrigation Company, and by a unanimous vote gave E. T. Meredith and his associates until June 1, 1917, to commence active construction work on the tract of land they had planned to water in Twin Falls county.

Utah

The stockholders of the Logan & Northern Irrigation Company met at Logan recently in annual meeting. The report of the secretary and treasurer showed that most of the \$5,000 fund received from the state a few years ago has been exhausted. The following directors were elected: W. H. Cantwell and Edwin Erickson of Smithfield, R. A. Perkes of Hyde Park and Peter Larson and Alma Olson of Logan.

A State Irrigation and Drainage

Congress will be held at Logan beginning January 31, during the week of the farmers' convention. Many important subjects will be discussed at this meeting, an account of which will appear in a future issue of the AGE.

Washington

L. M. Hilton of Granger, secretary of the Granger Irrigation District, has received from the Reclamation Service a blueprint plan of the irrigation system which it is said will be installed this year without fail. A 30-inch concrete pipe line will convey the water from the canal at Gurley's place to a

point near the top of the ridge, and from there an open ditch will run to a point further east and from there the water will be pumped to the top and distributed by pipe line to the high points. Eighteen hundred acres are embraced in this project, 1,500 acres being classed as fine agricultural land and 300 acres as part alkali land, this last being the lowland under the old lateral.

The following have been elected officers for the Pinecroft Irrigation Dis-

trict: C. H. Chrisman, three-year term; Abe Johnson, two-year term, and J. J. Kelly, one-year term.

Miscellaneous

In the case of Henry M. Thornton against Vernon Kingery and others, a suit from Scottsbluff county, Nebraska, the supreme court holds that the village of Gering, through which an irrigation ditch flows, must furnish him another lateral through which he may obtain water for the purpose of

(Continued on page 48)

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(Continued from page 47)

irrigating land which he owns and which is situated within the village and also within the irrigation district. He insisted on getting water from a certain lateral. The village can require him to take it from another lateral if it provides a suitable connection without cost to the water user.

Fergus county boasts of the latest irrigation project to be completed in Montana—the Winnett—that reclaims a fertile expanse of land in the eastern part of the state. Water will be delivered by the Winnett project to 11,000 acres next season. Eventually from 18,000 to 20,000 will be reclaimed. The work on this project was begun in the fall of 1911. Fifty-five miles of ditches have been built and reservoirs constructed at a cost of \$150,000. The water is stored in War Horse Butte lake reservoir, with a capacity of 27,000 acre-feet. The company was organized by Walter J. Winnett of Winnett, and Fred W. Akins, formerly a Government reclamation engineer.

North Dakota is soon to have another irrigation project of relatively small present importance, but of great future promise. E. C. Caudle, manager of the Alfalfa ranch, has advised State Engineer Bliss that he contemplates irrigating about 90 acres of land a short distance north of Marmarth, on the Little Missouri. It is Mr. Caudle's intention to plant the irrigated land to alfalfa.

The Colmor Irrigation and Land Company of Colmor, Colfax county, N. M., have filed articles of incorporation, with an authorized capital stock of \$200,000, and the company is starting with \$64,000 subscribed. The incorporators are William H. Filff and Paul Blount of Colmor, Edward H. Traylor and Nellie L. Traylor of Raton, and Margaret G. Wolf of San Antonio, Texas.



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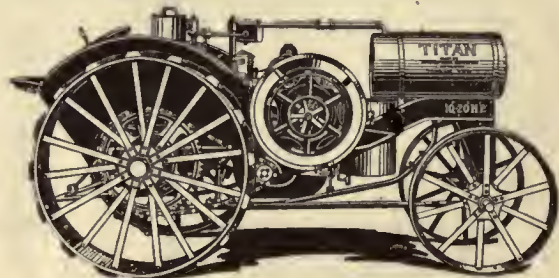
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Thirty-Second Year

THE IRRIGATION AGE

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No. 4

THE IRRIGATION AGE

With which is Merged

The National Land and Irrigation Journal

MODERN IRRIGATION

THE IRRIGATION ERA

ARIO AMERICA

THE WATER USERS' BULLETIN

THE DRAINAGE JOURNAL

MID-WEST

THE FARM HERALD

THE IRRIGATOR

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Official organ Federation of Tree Growing Clubs of America. D. H. Anderson, Secretary.

The Executive Committee of the National Federation of Water Users' Association has taken action whereby THE IRRIGATION AGE is created the official organ of this vast organization, representing 1,000,000 persons on the government irrigation projects.

Radical Revision Oregon Irrigation Law

A bill, the joint product of four members of the Oregon Irrigation Congress, Messrs. Percy A. Cupper, A. Lamgaard, Jay H. Upton and Albert E. Elder, was recently presented to the legislature of that State. This bill is one of the most striking that has so far been presented. It provides that all irrigation bonds, in order to become a legal investment, must have the certification of the secretary of state. This certification is to be given only when the bonds and the district upon which they are issued satisfy certain exacting conditions.

The supply of water for the project must be sufficient and the district must be entitled to a sufficient amount of water.

The soil of the district must be fertile and susceptible to irrigation.

The irrigation system must be feasible.

The market value of the water and all irrigation works must be reasonably high.

The aggregate amount of bonds issued upon any project must not exceed 60 per cent of the value of the lands, water rights, etc.

Sixty per cent of the irrigable land in the district must be under cultivation and raising crops, and 25 per cent of the land to be irrigated under the proposed system must be at the time of the bond issue irrigated and producing crops.

Not more than 10 per cent of the land in the district may be unappropriated government land open to entry.

The commission to investigate these conditions will consist of the state engineer, the attorney-general and the superintendent of banks.

Another innovation of the new bill is that when a petition for the organization of a district is signed by a majority of the land owners either within or without the limits of an incorporated city or town, that city or town may be included within an irrigation district.

Holders of bonds, says the bill, shall have a lien on the irrigation works and other property of the irrigation district in addition to the lien on the lands within the district.

This bill is worthy of serious consideration, and clause 6 is especially interesting, in view of the fact that if it becomes a law promoters of irrigation development will find it necessary to invest 60 per cent of the total in bringing the project to a point where money may be taken back from the sale of the bonds. The AGE may have a wrong conception of this bill, but a perusal of clause 6 leads us to believe that capital will act cautiously under this plan.

Heretofore, on a majority of the projects opened up, the bonds have been underwritten and sold and the proceeds or such part of them as were necessary

under state regulations have been used to build the works and distribution system, and this was usually done during the time that colonization work was going on.

It is possible that the AGE looks from the wrong angle at this plan, owing to a limited knowledge of local conditions in Oregon, but it makes the deduction from former proved conditions that no group of capitalists or landholders under a proposed project will make the outlay necessary, as provided by this bill without some apparently necessary changes.

King-Graves Congress Debate

We present in this issue the first installment of the debate at the International Irrigation Congress between Judge Will R. King, Chief Counsel, U. S. Reclamation Service, and Judge Carroll B. Graves of Seattle, Washington, on the Resolution "That Reclamation Can Be Undertaken More Advantageously by Government Activity Than by Private Enterprise."

Both of the gentlemen are students of a high class and this debate should be unusually interesting to all of our readers, both at home and in foreign countries.

Owing to the length of the report it will be impossible to publish it in complete form in one number. We will, therefore, present in this issue the talk by Judge King and the reply by Judge Graves, the summing up by Judge King will appear in our March number, which will complete the entire debate.

Our readers are requested to write the AGE expressing their views on either side. Contributions of this character will be reproduced in future numbers.

Elwood Mead Editorial Criticized

The AGE is brought to task by one of its readers for its comments in the December issue concerning Dr. Elwood Mead and his attitude as expressed in a report on Colonization and Rural Credits recently issued by the State Colonization Commission. Dr. Mead is chairman of that body.

The impression obtained from a perusal of The Orland Register was that this report was gotten out and signed by Dr. Mead as chairman of the Federal Cost Review Board, and we are glad to make this correction as suggested by our correspondent. It is claimed that the action of the Orland paper and Chamber of Commerce is not a reflection of the views of the settlers, but of the owners of large holdings in that vicinity, who are seeking for

settlers and who fear that the report of the Colonization Commission may cause a lowering of the price of land.

The AGE is glad to make correction in fairness to the friends of Dr. Mead.

Ogden Wants Irrigation Congress

Ogden, Utah, through its Board of Directors of the Ogden Publicity Bureau is discussing the advisability of making a bid for the International Irrigation Congress to be held in 1917. At the 1916 session of the Congress at El Paso, Texas, both the place of meeting and date for the next session were left open. The proposition made to the people of Ogden is that a sum of \$7,500 be guaranteed for what are considered necessary expenses, which includes \$3,500 as salary for the secretary; the other \$4,000 no doubt being for office help, stenographic work, etc.

Judging from comments in recent issues of the Ogden papers there is some question about the guarantee on the grounds that the city in which the Congress is held should be allowed to dictate the terms under which the Congress may be held there.

There is no more central point than Ogden, and judging from the manner in which the Congress of 1903 was handled by her enterprising citizens, a rousing meeting will result if the decision is favorable to Ogden.

There are no more enterprising, go-ahead men in any western city, and if such men as Fred J. Kesel, Messrs. Eccles, Wattis, Shurtliff, Wright, Beglow and other well-known citizens take the matter in hand, a successful Congress will result.

It is worth a trip across the Continent to see Ogden and meet with her enterprising citizens, and the scenic features are also alluring. The famous Ogden Canyon in itself presents views of surpassing grandeur.

If Ogden decides to entertain the Congress, all of our readers who can should plan to go, making that trip their summer outing. A decision will no doubt be arrived at in time for announcement in our March issue.

Greeley-Poudre Irrigation District

The Greeley-Poudre Irrigation District, Colorado-Wyoming, is attracting attention again, as it has been involved in very important litigation; the matter has been under way for several years and had extensive and detailed hearings, which were completed about a year ago. The argument before the Supreme Court was heard in December, but the decision has not been given

by the Supreme Court, nor is it likely to be rendered before May of this year.

This suit was brought by the State of Wyoming in the United States Supreme Court against the District and State of Colorado to prevent the diversion of water from the Laramie River through a tunnel twelve thousand feet long into the Poudre Valley. The Laramie River is not the only source of supply for the District, but would be the source of supply for approximately one-half.

The energies of the District have been more or less paralyzed by this suit.

The issues in the case brought by Wyoming were fundamentally that the diversion by Colorado of the waters of a portion of the watershed, practically one-fourth of the watershed of the Laramie in Colorado would interfere with the right of ditches in Wyoming and be a damage to the State. Wyoming also claimed that the taking of water from its natural shed was contrary to fundamental laws. The State of Colorado attempted to show that Wyoming would not be injured; that if she utilized her own water supply with ordinary care she has ample; that the situation did not justify the stand that Colorado should be required to hold a large area purely as a collecting ground for Wyoming, and that the diversion of water from one shed to another is a practice that has always been followed in all countries and civilizations, and in all the western States, and that Wyoming is not only doing it to a great extent, but that she herself is diverting water from the headwaters of the Poudre into the Laramie basin. The District has every reason to have confidence in the outcome, and while a favorable decision will not settle all its difficulties, it will encourage those interested to greater action, which will help bring new life to this promising section.

Chamberlin-Smith Irrigation Bill Second in importance in national reclamation legislation only to the original Reclamation Act will be the Chamberlain bill, if it becomes a law.

Briefly stated in general terms, the bill provides that when on application the Secretary of the Interior shall determine a project is feasible, and after organization of irrigation or drainage districts under the laws of the state, the Government will accept approved irrigation or drainage district bonds in sufficient sum to cover the cost of the project, to bear interest not exceeding four per centum per annum, and upon receipt of same the Secretary of the Treasury shall issue certificates of indebtedness in amounts of \$50 or

multiples thereof, in an amount equal to the face of the bonds. These certificates are to be disposed of to citizens of the United States at not less than their face value. The receipts from such sale are to be used in the construction of the project under direction of the government.

The certificates of indebtedness are to be retired by payments, principal and interest, of the district bonds and the present Reclamation fund will be called upon to make up any possible loss to the general treasury, to meet which a sinking fund is provided by setting aside each year a part of moneys annually coming in to the present Reclamation fund.

Under the bill both swamp and arid lands may be reclaimed and states on the Great Lakes, on the Mississippi River, on the Gulf, and on the Atlantic coast, which have large areas of swamp land, will find as much interest in the measure as do the irrigation states, where the bill has met warm approval.

The effect of the measure will be to make available for reclamation work, both irrigation and drainage, practically unlimited private capital at a low rate of interest. There is now no market for irrigation district bonds, except for developed projects, and if there were, the interest rate would be so high as to be too much of a burden to the future farmers. But under the guarantee of the Government, which is the effect of this bill, the interest will probably be less than 4 per cent.

There is but little hope of the present Reclamation fund increasing for many years so as to build many new projects, and the securing of money from the general Treasury seems distant. This bill is intended to obviate this difficulty by letting each project, whether irrigation or drainage, pay its way under the guarantee of the Government, the Government to build, take over and manage the same (with funds thus provided) in the same manner as projects now under its control are taken care of.

The country as a whole is concerned in the development of our agricultural resources everywhere, and not in any special form of reclamation.

This bill appears in full in this issue of the AGE. Several changes will no doubt be made in the bill in the committee. Further information and some possible changes may be suggested in our issue of March.

Every Federal water user should read The Irrigation Age.
It is fighting their battle. your neighbors do not take the
Age, tell them about it,

DEBATE BETWEEN JUDGE WILL R. KING AND JUDGE CARROLL B. GRAVES BEFORE INTERNATIONAL IRRIGATION CONGRESS, EL PASO, TEXAS



Judge King
Washington, D. C.

RESOLVED, THAT ARID- AND SWAMP-LAND RECLAMATION CAN BE UNDERTAKEN MORE ADVANTAGEOUSLY BY GOVERNMENT ACTIVITY THAN BY PRIVATE ENTERPRISE

Introduction by Mr. Richard F. Burges, President of the Congress



Judge Graves
Seattle, Wash.

In announcing the debate this evening, I said something about the contestants on either side of me, but after taking my seat I got to thinking about an untimely incident in the life of an honored lawyer in this State, back in the early days in East Texas, when men lost their tempers and sometimes undertook to settle their differences in court, if the sheriff was absent and only the court, in person, was present to preserve order. Upon this occasion two lawyers engaged in a very fierce altercation, and finally, in their wrath, each of them grabbed upon a chair and started for the other. That was in the old days, when the leather-bottom chair was, fortunately, still in use, instead of the heavier ones of modern make, and as the two assailants rushed at each other a third lawyer rushed in between them with hands outstretched in either direction and said, "Gentlemen, gentlemen, remember where you are." At that moment both of the chairs came together with considerable force, and each of them knocked out a round on the intervenor's head, who gathered his head between his hands and backed off and said to them, "Now, if you gentlemen will excuse me for butting in, you can beat each other to death." (Laughter.)

Now, admonished by his experience, the chair has decided not to sit between the contestants; he is going over here and sit on one side, and metaphorically speaking, of course, the congress would be glad to see the contestants beat each other to death. (Laughter.)

I have the honor of presenting, first, the Hon. Will R. King, chief counsel of the United States Reclamation Service, who will open the debate in favor of the proposition that irrigation and swamp-land reclamation can be undertaken more advantageously by government activity than by private enterprise. Ladies and gentlemen, Mr. King. (Applause.)

Opening Argument by Judge King

Judge King: Mr. Chairman, gentlemen, brother congressmen, and sister congresswomen. You see in these progressive days we have to recognize the ladies as well as the gentlemen. I must say that in listening to the charming music furnished this evening I almost forgot that I was to speak, and am afraid that I will forget what I intended to say, or rather, what I should say.

I want to say, however, my friends, that I esteem it a distinguished honor

to have the opportunity of addressing the International Congress upon this occasion and under these circumstances.

I am also gratified to see, even though Judge Graves and I are to be the victims here, that the congress is awakening to the fact that it is well to hear from both sides on important controversies.

I have often envied ministers in the pulpit, who in the exercise of their usual freedom, are able to speak without any opposition and can address audiences that naturally take it for granted that everything they may say is necessarily right and logical, or at least the speakers think so, because no one in their audiences dares question their position. And I fear that in this great country of ours, in the last 30 or 40 years, since debates have been on the decline, there has been developed among the people the same weakness in connection with the average speaker, of imagining that because no one opposes what he says that, therefore, what he says is the law and gospel.

It is much easier, as all of us know who have made the experiment, to speak when we know that no one is going to oppose us and that when we go home and lie down to pleasant dreams we may allow those who desire to criticize us to do so in our absence.

But when one goes before an audience, as I am doing here, without a previously prepared written address, and knowing before hand that he has one of the most distinguished critics and able lawyers and jurists of our great western country in opposition to him, he realizes that he must be very careful in what he says. Hence, I am more likely to say too little, at least so far as my intentions are concerned, than to say too much, for I know that Judge Graves will stand ready at any time to call me down should I make a misstatement of fact or become illogical in my argument and be caught in the effort.

As was said by Secretary Jones in his masterly address at the dedication of the Elephant Butte Dam, we have reached a critical stage in the reclamation work and one demanding careful consideration. I am reminded by this of an incident occurring during the Battle of Waterloo, when Blucher with his army was marching to the relief of Wellington, at a time when Napoleon was on the verge of victory. The army came to where two

roads forked and not knowing which one to take, the general in charge asked a little barefoot boy standing by the wayside which road led to Waterloo. The boy, pointing, said: "Go this way." The army acted on his directions, and as a result Wellington won and the map of Europe remained unchanged. Now, I feel that I am only the little boy who will attempt to tell you tonight which way the people who desire to reclaim the arid and swamp lands of our country should go, and Judge Graves is the larger boy, who will endeavor to tell you to take the other road. At least I assume so by reason of the fact that he is on the negative side of this question.

I now want to call your attention to the fact that the question, as stated, includes both swamp lands and arid lands. It reads:

"Resolved, That irrigation and swamp-land reclamation can be undertaken more advantageously by government activity than by private enterprise."

Of course, we must take the past more or less as an evidence of what may be done in the future on the theory that we can, as a rule, judge the future largely by the past.

In debating a question there are always certain things upon which both sides agree. One of them in this case is that we have about sixteen states in the West which, with but one or two exceptions, would still remain territories were it not for the reclamation of their lands by irrigation. Were it not that we have the opportunity to reclaim and have the water with which to irrigate the lands all, except possibly Oregon, Washington and California would still be territories.

In Washington, the state in which Judge Graves lives, and in Oregon, the one in which I live, the western parts, which comprise about half of these states, have ditches to run the water off the land, while the eastern parts have ditches to run the water on the land. Hence, regardless of irrigation, those two states, so far as the western halves are concerned, would each have been a success without irrigation, as would also northern California. But when you take the southern part of California and the eastern part of Oregon and Washington and all the Rocky Mountain States they would still have been territories and practically worthless except for the purpose of raising stock on a limited

scale were it not for irrigation. To that extent we will agree.

I take it that we will agree also that in the beginning the private irrigationists, such as those who would divert small ditches from the streams and narrow ravines, where there was an abundance of water so far as the land which they were then trying to farm was concerned were a success. After a limited time it became necessary for the farmers to organize into mutual companies and those to a large extent were a success. But that success extended only up to the limit of the water which could be diverted without large expense and without making it necessary to provide for water storage.

Then corporate enterprises undertook the problem, developing naturally in due course of time into irrigation districts, one step farther in the direction of reclaiming lands which the private ditches and the mutual companies could not reach.

A number of these enterprises in the form of irrigation districts in places in California, and other places where they were favored by nature, by the water supply, and the amount of diversion, proved successful, but they soon reached their limit, and as an evidence of the fact that they reached their limit, and as a further evidence of the fact that the country had reached the point where private enterprises and corporate enterprises could not longer reclaim the public lands successfully, the irrigation congress was born. That in itself affords strong evidence of the fact that even the corporations and irrigation districts were not able to cope with the conditions with which they were confronted. This made it necessary in the early stages and early history of this problem that the people should gather together, as you are here, to devise some way by which they could secure governmental relief.

It is evident, therefore, that from every state from which delegates were sent (eventually resulting in the securing of the passage of the Reclamation act in 1902), it was deemed by the most representative citizens of those states that the time had arrived when governmental assistance was necessary.

It was remarked by someone here today, "Why is it that we do not have so large an attendance now as we had in 1904, when we attended the congress here?" The reason is very easily explained. At that time and prior to 1902 the projects had not been completed; they were only in process of construction or in contemplation, and consequently every state was interested—there was a lively interest in every project. Every one of the 26 projects now constructed or under process of construction had their delegates here. But now we have reached the time when most of these projects are well on the way to completion, and as a rule the people under those projects deem it unnecessary for their representatives to come, as they did before, and those who are coming now are principally those who look forward to the building of other

and additional projects. I think, therefore, ladies and gentlemen, that these circumstances which I have enumerated in themselves strongly tend to demonstrate that reclamation can be undertaken more advantageously by government activity than by private and corporate enterprises. It is not conclusive evidence, I will admit, but it is certainly strong circumstantial evidence.

Now, it will probably be contended that the projects constructed by our government have required enormous expenditures of money. But in that connection let it be remembered that the most feasible and cheapest projects had already been undertaken or built. The farmer could go above his farm half a mile or a mile and divert the water on to his farm with but little cost, nor did he even count his own labor as a part of the expense.

The farmers' corporation, such as the Nevada Ditch Company, in the county in which I live (Malheur county, Ore.), and in which several hundred people are interested, did all its own work, hence did not count that as a part of the expense. What is more, up to the time that the Reclamation Service became very active, labor was cheaper, there were no eight-hour law regulations, materials were cheaper, and the works could accordingly be constructed with much less expense than they can now or since the government has entered into the building of irrigation projects.

In this connection I want to make the assertoin—and I think I am safe in making it—that if you investigate the projects in the United States constructed under private corporate systems within the last 20 years you will find that not more than 10 per cent of them have been successful. But when you come to the government projects, about 26 in number, more than 90 per cent of them have been successful. When I say 90 per cent, I speak of them in numbers; but if you consider the acreage irrigated and storage capacity of the reservoirs, I feel safe in saying that 98 per cent of them have been successful.

Take, for example, the Hondo project—we will concede that was a failure; that the bottom fell out of the reservoir; that is, the water disappeared, probably to supply artesian wells elsewhere. But that was something we could not foresee.

The only other failure is the Garden City project, over in Kansas. It is a small project. The failure was due to the fact that copious rains happened there for three or four years, and the farmers concluded that they did not need the project and would not use or pay for the works.

When you take the acreage reclaimed under these various projects and available acreage supply of the reservoirs built, I feel safe in asserting that 98 per cent of the government projects have been a success and that no more than 10 per cent of the corporate private enterprises have been a success. There is other evidence of that fact, but before coming to that point I will cite a few instances:

Go over in the Grand Valley in Colorado and you will find the Orchard Mesa project, constructed by private capital. It cost in the neighborhood of \$120 per acre. They are paying 6 per cent interest upon more than a million dollars in bonds. The bonds, in the first instance, had to be sold at such discount that the project perhaps did not receive a million dollars, and yet the bonded indebtedness is over a million dollars. The flumes, etc., are giving way, and much of the works must now be replaced, and the people interested are now willing to turn the project over to the government at a great loss. Just what they would do in that regard or how far they would go I do not know, but I do know the bondholders would be willing to turn it over to the government at a great sacrifice if the government would take it, and the farmers there are praying to the Reclamation Service to come to their rescue.

We have applications from bondholders of various projects offering to knock off hundreds of thousands of dollars if the government will take over the projects and run them.

Again, the government works are nearly always more substantially constructed. They never wash out, while dams built by private corporations frequently do. Take, for example, a project in one state, which it is not necessary to name, in which a dam nearly a mile in length and 130 feet in height was built by merely dumping dirt off a railroad trestle. The engineers in the employ of the project deemed it sound, but it soon gave way and proved to be a failure, after an expenditure of hundreds of thousands of dollars, leaving the farmers in a deplorable condition. That affords an illustration of the character of work frequently done upon the projects constructed with private capital. But we have no instance where government works have given way. And why? It is because of the better workmanship and more careful management and the greater care with which the engineers in the employ of the United States have guarded against any accidents of that kind.

The reason for it is this, that the government engineers have no monetary interests at stake in the project. They have at stake their reputations as engineers. They have no bosses ordering them to close up the work this year or that, in order to turn same over and thereby receive the early and much coveted profits. They have sufficient time in which to build the projects and to build them properly. They make sure that the projects will be permanent and will last forever. But the builders of private projects are so anxious to reduce the expenses to the minimum and receive as early as possible the maximum price per acre for the land, in order to acquire immense and quick profits, that the tendency is to force their engineers to slight the work, close up the project and turn it over to the settlers as quickly as possible, and leave the farmers under it to proceed as best they can. As a result, we read

time and again of their dams giving way, and of the farmers under them being financially ruined.

Now, a further evidence of the fact that the government projects are more efficient and more to be desired and more practical is that we find, as in the North Platte, the Boise Valley, the State of Washington, and in practically all of the projects where we have a surplus storage water supply, that the managers of even the best canals—those that are prior in time and prior in right and which were constructed in early days, and which had, as was supposed, an abundant water supply—are making application to the government for the surplus, for a supplemental water supply from the government. They discover that when their neighbors under the government projects plant their crops and grow four crops of alfalfa, while on private projects but from one to three crops are grown, there is a reason for it, and that is that those under the government works have water throughout the season, while the private ditches without storage water can have the water only so long as it flows in the river, which flow usually ceases early in the irrigation season. They thought nothing of that until after the government projects were constructed or until they had an opportunity to see the difference demonstrated, when they soon learned that it would be better to have an interest in the government water supply to supplement the limited supply at their command.

The result is that in the vicinity of North Yakima we have sold a large amount of water as a supplemental water supply. Likewise we have sold a large amount in the North Platte, where they have one of the best private irrigation systems in the United States. And we are today preparing to sell water to several large canals in the Boise Valley, where they once assumed they had an abundance of water, having in fact one of the fine private systems of the West.

That is evidence, I think, ladies and gentlemen, of the fact that the government projects are more efficient, more effective, and more practical, and why is it? It is for the reason that the government so constructs its reservoirs as to provide a surplus of water to meet the demands of dry seasons.

I know of no instance where a private or corporate project ever provided for a storage supply on any large scale. In some instances, here and there, small reservoirs holding a few thousand acre-feet of water have been built. But compare these with the government structures—the Roosevelt Dam, with its 1,300,000 acre-feet, which is sufficient water to cover 1,300,000 acres one foot deep; the Arrowrock Dam, with 250,000 acre-feet; the Pathfinder Dam, with 1,000,000 acre-feet; the Shoshone Dam, with 465,000 acre-feet; the Jackson Lake Dam, with 900,000 acre-feet; and the Elephant Butte Dam, with 2,500,000 acre-feet. The Elephant Butte is the largest storage reservoir for irriga-

tion purposes in the whole world, not excepting those in Egypt.

It is only necessary to call attention to this condition to convince anyone, as I take it, that corporate enterprises and irrigation districts, if conducted independent of the government, would never have been able to produce the capital with which to construct these immense reservoirs.

It is the water supply then to which I want to call your attention, as one of the great advantages which the government affords to the farms of the West. It is not so much a question of the ability of the canals to divert the water, as was the case before the government entered into these enterprises, as it is the matter of the storage of the water, to tide the people over the dry seasons.

Take, for instance, the Pathfinder Dam. The water is stored there in such abundance as to meet all requirements of irrigation for at least one or two seasons in case of a drouth. Not every year will the feeding streams fill that reservoir, or the Roosevelt Reservoir, but each is made large enough so that if any dry season comes, and a sufficient water supply is not available in the stream, the project will have on hand a surplus left over from former years to provide for the irrigation of the land. It needs only to be mentioned, that you may see that private enterprises could never have undertaken this, or at least, would never have done so.

There is another reason. Those who avail themselves of the benefits of the government reclamation work have to pay no interest on the investment and should not, while in all instances within my knowledge, under irrigation systems, where projects are operated independently of the government and private capital is used, 6 per cent per annum is paid upon the investment.

Before going farther into that I will say that I have had a careful computation made of 15 of the largest projects of the Reclamation Service and 15 of the largest projects in the United States built by private capital and I find that the average cost for the government projects has been \$47 per acre, while the average cost of the private and corporate enterprises has been \$65 per acre. On this \$47 per acre the farmer has to pay no interest; on the \$65 per acre he pays 6 per cent annually.

But for the sake of the argument let us suppose that each pays the same; let us assume that the government project costs the same per acre as the private project. But before making the comparison let us keep in mind that the best way to understand this proposition is to take into consideration that the one paying the \$47 per acre at the end of 20 years has paid only \$47 for each acre; but the one who pays \$65 per acre when you compute the interest—not compound interest but straight interest—you will find that he has paid more than \$125 per acre, or about \$70 more than the one whose lands were irrigated by a project built at the same price per acre under the

government plan. But assume, for the sake of the argument, that it cost the same, \$65. You have the farmer paying \$65 per acre, plus that much more for the private or corporate project than you must pay under the government project and yet they started off even.

We hear a great deal of complaint about the farmers not being able to pay (or have heard it in the past, but they are getting over it lately since they began to raise immense crops)—about the farmers not being able to pay the price per acre which the government charges, as if it were an unfair obligation. The burden of the song of those who have the land to sell is that it would be better to have the land under the private enterprise or the corporate enterprise, notwithstanding it would mean a construction charge of \$65, plus more than an equal amount in interest in 20 years, under any system constructed by private capital that you can figure out.

I have had this computed, figuring straight interest upon \$47, and if you will take what the farmer saves upon that interest by not having to pay it, you will find that at the end of 20 years he has saved about \$30 per acre interest upon the investment, leaving it to cost him \$17 per acre in place of \$47, when measured from the straight interest standpoint. But if you want to go further and compute it upon the compound-interest plan, if the farmer will loan out what he saves each year—if he will turn it over to the banker to be handled by legitimate banking methods, you will find that at the end of 20 years he will have his water right paid for and will have between \$50 and \$60 per acre in the bank.

That may sound strange, but if you have any doubt about it, figure it up; if you can not figure it up, get your banker to figure it for you; you will see the result is about as I have stated it.

I am reminded of the sign of a real estate agent over in Utah or some other state; I am not certain about the state. He was running a post-office and a store, and a blacksmith shop, and a shoe shop, and various other things. He was an up-to-date man. His specialty, however, was the real-estate business. (Laughter.) In the exercise of his good business judgment he had put up a sign on his postoffice and store, which read: **Here is the place to come to buy your land. The government builds the project, puts the water on your land, and charges you 5 per cent interest for 20 years, and then gives you the principal.** (Laughter and applause.)

And that is exactly what it is, any way you want to figure it. If you pay 5 per cent per annum for 20 years you will have paid the principal; or you pay 5 per cent interest for 20 years and are given the principal.

Think what the result would have been when the government first started out on this venture, when it first entered upon the reclamation of arid lands, if its officials had said, "If

you will pay us 5 per cent for 20 years we will give you the principal." Why, even our good friend, Judge Graves, would have jumped at that chance, and he would have taken up all the arid land under government projects that he could have found if he could only have been assured that, all he would have to do would be to pay 5 per cent per annum and then be given the principal at the end of 20 years. (Laughter.)

Well, that is one difference between the two systems.

But to say they cost the same is not really a fair statement, when we consider the permanency of the work, which I have just discussed. When we consider the care with which the engineers of the Reclamation Service, in order to insure their engineering reputations, without hope of other rewards, venture upon the building of a project, and the permanency of the work, and the abiding assurance that when the dam is placed in the stream it will remain there forever, you will observe, if you will look into it, that you get more than twice as much for your money, even figured at the same price, as you get under a corporate or private enterprise.

The tendency of the people who believe in the corporate irrigation plan with private capital is to think that just so long as you have a dam, that is all you need. They reason something like this:

A dam will hold water;

A pile of earth is a dam;

Therefore a pile of earth will hold water.

That is the way a great many people reason on this subject; that is the way the engineers figured it when they built a dam a mile in length by merely dumping dirt and debris from a railroad trestle, making it 130 feet high and about a mile in length, and pronounced it safe. They had the earth, hence the dam, but it wasn't in fact a real dam, as subsequent experience proved to the great sorrow of the farmers who paid the bills.

Yet, in making estimates and in comparing the two kinds of works, the tendency is to say that the dam, when it was placed in there, cost the farmer, we will say, \$65 per acre to reclaim his land; while the Government might place another dam in a canyon somewhere and build a reservoir like some that we have at a cost of \$65 per acre and that dam will be there when Gabriel blows his horn, while the dam built with private capital will last but a few years. Yet, we are asked to compare the two and say that each costs the same per acre. As a matter of practice, the private enterprise, under any system by which you can figure it, will cost more than twice as much per acre.

Now ladies and gentlemen, I think when we take into consideration the difference in the manner of construction, when we take into consideration the fact that no interest is to be paid upon the investment, and that the government has provided a revolving fund—that is, that the money invested returns to the government and is used

for the reclamation of other lands; that the farmer does not have to pay any profit on the investment, as he does in the private enterprises—it would seem clear that the affirmative of this resolution, to the effect that reclamation can be undertaken more advantageously and more economically by government activity than by private enterprise, is amply demonstrated; and this applies not alone to desert and arid lands of the West but with equal force to the reclamation of swamp lands.

The money invested in the private enterprise does not come back, as a revolving fund, to reach these different lands; or when it does come back, it comes with an immense profit, as was shown by the investigation which was held in Montana, I believe, which brought to light the information that the profits, where private capital built the project, were about \$40 per acre.

Our Reclamation Service has duties thrust upon it not found in any other bureau. Other departments spend the money and bid it "good-by," while we must spend the money and provide for its *safe return*. (Laughter.) And it is well that we must do so, for its safe arrival from its starting point insures the building of more projects for which you and I and all of us are hoping today. (Applause.)

I am familiar with two or three enterprises in my county in eastern Oregon, projects which were built by private capital, and which, by their owners, are deemed successful. One of them thus far has not been put into operation, but there is sufficient land under it, and temporarily, at least, the dam appears to be a success. There is another, which has a pumping plant, and which pumps the water out of Snake river, about 80 feet, and which is a partial success. There is another farther up the valley which is also a partial success. But I was surprised when I asked how much per acre each of these projects was charging for the water right to learn that such charge runs from \$100 to \$110 per acre.

I know that country well enough (having lived there most of my life) to know that it did not cost half the amount named to build those projects; that is, it did not cost more than half that amount to construct them, but with the profits to be paid the promoters it will cost the farmers that amount. When the cost to the farmers is figured, you must estimate it from the standpoint of what the farmer has to pay, and in these instances I have mentioned the farmer has to pay at least \$50 per acre profit to the promoters.

The last time I was in eastern Oregon a committee from one of these projects met me and wanted to know if there was not some way that they could persuade the Reclamation Service to take over this project. They are tired of it already.

Go over into the Snake River Valley, on the south side of the Snake river in Idaho, just across the line from Oregon. We find there a pri-

vate project which cost something like \$100 per acre, paying 6 per cent interest, and yet we find they do not have an available water supply, because they have not the power with which to pump the water out of Snake river.

You can go to the King Hill project, farther east in Idaho, which private capital constructed at immense cost. It is now in the hands of a receiver, and they have come to the Reclamation Service urging us to assist them in providing some way by which the government can take up this project and save the farmers who are under it from ruin. Those who built the project are, in fact, on the verge of bankruptcy, if not already there; at least, the project went into the hands of a receiver, and the State has finally had to come to the rescue so as to permit the farmers temporarily to farm their lands.

We might go on and cite many other instances. You can go into an examination of the Carey projects—I have a list of over 100 of them—and I think it safe to assert that not more than 10 per cent, if that many, have been successful. I know of only two or three, and they are only partial successes. With the exception of one, I don't know of any of them that would not welcome the Reclamation Service in taking over their project. There may be more. I only assert that I have not heard of them.

We are reaching a time in the history of these projects and in this work when we must decide—yes, the people who elect the senators and congressmen must decide—whether those interested in the 25,000,000 acres of arid lands of the West and the 75,000,000 acres of swamp lands in the South, East, West, and North are to depend upon the government for further aid, or whether rivers and harbors shall be the only "pets" of Uncle Sam. The good farmers of the country, who are the builders of our homes and who are the best insurance of the permanency of this great Republic, should be permitted to have their lands reclaimed, with the assurance that the money expended will be returned to our great and good government in order to build other good projects and add thereto the permanency of an inestimable number of happy homes.

Since we have gone, I might say, 300 years without accomplishing anything further than the reclamation of small strips of land along the streams until the government came to the rescue, is it not reasonable to assume that that will continue if private capital must be depended upon? When you take into consideration that the taxable value of property has more than doubled in every county where there is a government reclamation project, is it not reasonable to assume that the government reclamation work is more feasible, more efficient, and more practical than that done by private enterprise?

Take, for example, Maricopa county, Ariz. In 1902 the taxable value of the property there was about \$9,000,000; in 1915, after the construc-

tion of the reclamation project, those values had increased \$64,000,000. Going back to the beginning of irrigation in that county, you will find that we are taken back, as I understand it, to a time when irrigation was carried on by the Indians, about 1833. The way this date was ascertained is historically and psychologically interesting. It was found out in the trial of a water suit in the Salt River Valley. A very old Indian was called to testify regarding the early appropriation of water in that valley by the Indians. Their water rights were at stake in that suit. He was asked when they made their first preparation for irrigation. He knew nothing about "years," but he told the court it was about "three summers before the stars fell," and, as you will recall, along about 1830 they had a great shower of what are called falling stars or some kind of meteoric display in which nature, when on a vacation, sometimes indulges. That appeared to have been the beginning of irrigation work in that country.

Now, from that time up to 1902 the taxable values of the property of that county had only attained the sum of \$9,000,000, but since the Reclamation Service has built the Roosevelt Dam and enabled the farmers to raise crops throughout the entire irrigation season, the taxable values of property up to 1915 have increased to about \$75,000,000.

There is a sample of your government reclamation work. How long, yes, how long, would it have been before corporate or private capital would have placed a dam in that stream which would have increased

the taxable values of property in that county one-tenth that much? The people tried it for years; they had the first water right, or rather only a portion of a water right, as was discovered afterwards. The government project increased the production of alfalfa from two or three crops per year, even in the comparatively small localities, where producers had a prior water right, to six crops, and I have heard it claimed that they now raise crops 13 months out of the year there, but I doubt it. (Laughter.) But anyway they raise six crops of alfalfa a year, and they raise citrus fruit, and they have their orange crops, none of which they would have except on a very limited scale, were it not for the government reclamation work.

Now, ladies and gentlemen, I believe I have about taken up the time allotted to me for the opening argument. There are many things which I would like to say and I feel that I could take another hour on this, but I am reminded in that regard of when I was on the supreme bench in my good and great State of Oregon. Long-winded talkers would appear before the court occasionally. One, after talking four hours, apologized for not having ample time in which to present his case. As a result, we finally limited the time to one hour on each side. It is a habit among lawyers while arguing a case, occasionally to ask: "How much more time have I?" I slipped a note over to the chief justice on one or two occasions when I was on the bench, which read: "Why don't you tell him

that he does not have to talk the full time unless he wants to?" Well, the chief justice finally did so, but gave me credit for the suggestion, so as to escape the vengeance of the lawyer who was talking. About three weeks later I was, by the good voters of Oregon, forcibly retired from the bench, and resumed the practice of law. (Laughter.) I was called upon at once to argue a case before the supreme court. We had 1 hour to the side, and after I had taken about 20 minutes, true to the habit of the bar, I asked, "If your honors please, how much time have I?" "Well," responded Chief Justice Moore, "you have about 40 minutes more, but remember what you suggested as to others when you sat beside me here, and that is, you don't have to talk the full time unless you want to." (Laughter.) At all times since then I have approached an audience with a painful realization of the fact that it is advisable to quit talking when I am through. (Laughter.)

I observe that I still have two minutes of the time allotted to me, but realizing that I do not have to take it all unless I want to do so, I will now take pleasure in closing and will turn this matter over to my distinguished opponent, the able jurist and orator, Judge Carroll B. Graves. (Applause.)

President Burges: Ladies and gentlemen, I am sure that we have been entertained and instructed by the opening argument of Judge King and I now have the honor of presenting to you Judge Carroll B. Graves, of Seattle, Washington, the speaker who will be heard on the other side of this question. (Applause.)

CONSERVE YOUR WATER BY CULTIVATION

Experiments in California Show 26 Per Cent of Loss by Evaporation May Be Saved

The following experiments may be of interest to many Colorado farmers. They were carried on in California and the object of the experiment was to determine as nearly as possible the amount of irrigation waters that could be saved by means of cultivation. The experiments to determine this effect were made so as to approach ordinary field conditions and practice as nearly as possible. An irrigation amounting to six inches in depth of water was applied to the surface of the soil and allowed to soak into the same. It took from six to twenty-four hours to accomplish this, depending upon the character of the soil. From one to four days after the water had been applied, the fields were cultivated and a second cultivation was given two weeks after the application of the water. The total average evaporation loss in twenty-eight days from uncultivated soil was 2.14 inches, or 35 per cent of the water applied, and it was found that cultivation saved about 26 per cent of this lot. During our dry summers in Colorado, when our irrigation supply is short, this saving of 26 per cent of the evaporation loss may often turn failure into success for

that season. It is, therefore, in my judgment, well worth remembering by the average farmer of Colorado.—E. B. House, Colorado Agricultural College, Fort Collins, Colorado.

SOME OF THE WORLD'S BIG DAMS

The largest masonry dam in Europe is in Spain. It is built across the chasm through which the Noguera Pallaresa river flows, and is situated near the town of Tallarn. This dam is a magnificent masonry structure, 330 feet high and 700 feet long, and was designed and built under the direction of American engineers.

In South Africa we also find another large masonry dam. It is the dam which stores the water for the Hartebeestpoort irrigation system. The work on this dam has been suspended on account of the European war. The dam is near Pretoria. Its maximum height is 199 feet.

Let us now compare these dams with those found in America, and it is interesting to note that we are continually building larger and larger dams in this country for irrigation and storage purposes. It was only a few years ago when we read of the amazing height of the Shoshone dam, 328 feet high and 200 feet long. A little later the Arrowrock dam came to attract the attention of the public. This is the highest of all American masonry dams, 349 feet high and 1,100 feet long. The Elephant Butte dam has just been constructed, 318 feet high and 1,674 feet long. All of these dams are of concrete.

BILL TO PROMOTE RECLAMATION OF ARID AND SWAMP LANDS

Introduced by Mr. Smith of Idaho in the House of Representatives, Dec. 2, 1916, and Referred to the Committee of Irrigation of Arid Lands.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That beginning with July first, nineteen hundred and seventeen, there shall be paid out of the receipts of the reclamation fund the sum of \$500,000 per annum into a special fund in the treasury of the United States, to be known as the reclamation guaranty fund, until such reclamation guaranty fund reaches a total of \$10,000,000, to be used to reimburse the general funds of the Treasury of the United States for any costs, losses, or expenses not otherwise provided for, which may be incurred under the provisions of this Act. Should said reclamation guaranty fund ever become exhausted in the payment of obligations incurred under the provisions of this Act, then from such time the sum of \$1,000,000 shall be paid each year out of the receipts of the reclamation fund until such reclamation guaranty fund again reaches the sum of \$10,000,000.

Sec. 2. That when the Secretary of the Interior, pursuant to the provisions of the Reclamation Act of June seventeenth, nineteen hundred and two, and Acts amendatory thereof and supplementary thereto, hereinafter referred to as the reclamation law, shall have determined that the construction of a project or unit of a project for the reclamation of arid and semiarid lands is practical and advisable, or if he shall determine that any project for the drainage of any swamp lands is practicable and advisable, and shall have approved of the construction thereof under the provisions of the Act, the Secretary of the Interior is authorized to enter into contract or contracts with an irrigation or drainage district or districts, including such lands, which are duly organized under the laws of the State or States in which such lands are located, and thereafter to provide for the construction of the necessary work under the provisions of this Act for the reclamation of such lands.

Sec. 3. That when such district or districts shall have duly voted and issued bonds bearing interest at a rate to be fixed by the Secretary of the Interior not to exceed four per centum per annum, in sufficient amount to cover the cost of such project as estimated by the Secretary of the Interior, and the legality and validity of such bond issue shall have been duly confirmed by the courts in the manner provided by the State laws and upon the execution of contract or contracts between the district or districts and the Secretary of the Interior, he is authorized to accept such district bonds and deposit the same with the Secretary of the Treasury, who shall collect the principal and interest thereof and apply the same to the payment of the principal and interest of the certificates of indebtedness hereinafter authorized: Provided, That the total face value of such irrigation or drainage dis-

trict bonds accepted by the Secretary of the Interior shall not for any one project exceed the sum of \$25,000,000.

Sec. 4. That upon the receipt by the Secretary of the Treasury of such district bonds he shall issue certificates of indebtedness of the United States in amount equal to the face value of such district bonds and bearing interest at the same rate in such form as he may prescribe and in denominations of \$50 or multiples thereof, the principal and interest to be payable in gold coin of the United States, the principal and interest thereof to become due not less than sixty days after the due date of the principal and interest of the corresponding district bonds, respectively. Such certificates of indebtedness shall run for the same period as the corresponding district bonds.

Sec. 5. That from time to time, as funds may be required by the Secretary of the Interior for construction purposes, such certificates of indebtedness shall be disposed of by the Secretary of the Interior, under such rules and regulations as he may prescribe, giving all citizens of the United States an equal opportunity to subscribe therefor, but no commission shall be allowed, and the aggregate issue of such certificates shall not exceed the amount of the district bonds deposited with the Secretary of the Treasury and shall in no event exceed the sum of \$25,000,000 for any one project, and the proceeds from the sale of such certificates of indebtedness shall be deposited in a special project fund to be used in carrying out the provisions of this Act for said project.

Sec. 6. That the Secretary of the Interior is hereby authorized to expend the moneys in any such project fund for constructing the necessary works in the same manner and under the same conditions as expenditures are provided for in the said reclamation law, which shall be applicable to the said works in all respects, except as herein specifically modified.

Sec. 7. That should a surplus remain from the proceeds of the sale of such certificates of indebtedness issued in connection with any project after the construction of the works provided for in the contract or contracts, such surplus may be used in the construction of additional works in connection with said project provided for by supplemental contract or contracts, or the same may be used in the operation and maintenance of the works of the project or credited as payment of interest on the district bonds issued on account of said project until exhausted. All contracts hereunder with such districts shall limit the expenditures to be made by the United States to the proceeds of the certificates of indebtedness issued on account of bonds for such district or districts and may provide for the issue and deposit of additional bonds should the bonds

originally deposited prove insufficient in amount. If, in the opinion of the Secretary of the Interior, sufficient funds are available in the reclamation fund, the construction of the proposed works for the reclamation or arid or semiarid lands within the States named in the reclamation law may be paid wholly or in part out of the reclamation fund, and the said reclamation fund shall be reimbursed for any sums so used therefrom.

Sec. 8. That the certificates of indebtedness herein authorized shall be exempt from taxes or duties of the United States as well as from taxation in any form by or under the State, municipal, or local authority, and a sum not exceeding one-tenth of one per centum of the amount of the certificates of indebtedness issued under this Act is hereby appropriated out of the said reclamation fund to pay the expense of preparing, advertising, and issuing the same: Provided, That the reclamation fund shall be reimbursed for such expenditure out of the proceeds of the sale of such certificates of indebtedness, which expense shall be charged to the district or districts in the same manner as all other expenses in connection with the construction of the project works.

Sec. 9. That should the collections of principal or interest on any district bond issue deposited with the Secretary of the Treasury be insufficient to meet the payment of the principal or interest of the corresponding certificates of indebtedness, then the general funds of the Treasury shall be reimbursed for any such deficiency out of the reclamation guaranty fund, and should any such defaulted bond, interest or principal be collected after such reimbursement of the general fund, then such collection shall be credited to the said reclamation guaranty fund.

Sec. 10. That upon default of any installment of the principal and interest of any district bond so accepted and deposited, the Secretary of the Interior may declare the entire amount of such issue in default, and through the Attorney General of the United States may cause suit to be instituted for the collection of the amount in default of principal or interest or the entire amount of such bond issue, principal and interest, and the Attorney General shall, upon request of the Secretary of the Interior under this Act, cause proceedings to be commenced for the recovery of said amounts within ninety days from the receipt of the application at the Department of Justice.

Sec. 11. That unentered public lands of the United States proposed to be irrigated or drained under any project under the provisions of this Act shall be divided into farm units of areas which, in the opinion of the Secretary of the Interior, may be reasonably required for the support of a family upon the lands in question, and the Secretary of the Interior is hereby authorized to have such farm units appraised and from time to time to advertise and sell the same in such portions or units of the project as he shall deem advisable, at public auction for cash to the highest bidder at not less than the appraised value thereof, not more than one farm unit being sold to any one person, and such sale shall be subject to the conditions hereinafter provided in regard to the reclamation and drainage

thereof. Should any such land remain unsold at such public auction it may thereafter be sold at private sale for cash at not less than the appraised value, and should any such land remain unsold at private sale it may be reappraised from time to time at intervals of two years and sold at public auction or private sale, as in this section provided.

Sec. 12. That for lands so sold contracts of sale shall be issued subject to the condition that within two years after the date of notice by the Secretary of the Interior that water is available for the irrigation of such farm unit, or drainage capacity is available therefor, that the purchaser shall have cleared (where clearing is required), drained, cultivated, prepared for irrigation or agricultural uses, in the manner required by the Secretary of the Interior at least one-eighth of the irrigable or reclaimable acreage of such farm unit and made proof of the irrigation or drainage thereof, satisfactory to the Secretary of the Interior; one-fourth of the irrigable or reclaimable acreage shall be reclaimed and drained within three years, three-eighths within four years, and one-half within five years after the date of such notice by the Secretary of the Interior. Upon proof satisfactory to the Secretary of the Interior, of the reclamation and drainage of one-half the irrigable or reclaimable acreage at any time before or after said period of five years, patent shall issue to the purchaser or his assignee holding an assignment duly filed in the local land office, but should such purchaser fail to make proof in any year of the irrigation, drainage, and reclamation of the acreage as herein required or to make proof of the irrigation, reclamation, and drainage of one-half the irrigable and reclaimable acreage within a period of ten years, then such contract, together with all payments made thereon, shall be subject to forfeiture by the Secretary of the Interior, and the land shall revert to the United States to be again appraised and sold in like manner as hereinbefore provided.

Sec. 13. That from the money received from such sales of land the expense of appraisement and sale paid from the reclamation or project fund shall be deducted and the balance shall be turned into the reclamation fund, and may, in the discretion of the Secretary of the Interior, be used in the construction of proposed projects either under this Act or under the reclamation law.

Sec. 14. That the unpatented lands of the United States within the limits of any district with which contract is made by the Secretary of the Interior shall be subject to the provisions of the Act entitled "An Act to promote the reclamation of arid lands, approved August eleventh, nineteen hundred and sixteen" (Thirty-ninth Statutes, page five hundred and six).

Sec. 15. That the Secretary of the Interior is hereby authorized to perform any and all acts and to make such rules and regulations as may be necessary and proper for the purpose of carrying the provisions of this Act into full force and effect.

If you want to keep in touch with all sides of the Reclamation Problem send \$1.00 for one year's subscription to the Irrigation Age, 30 North Dearborn street, Chicago.

IDAHO IRRIGATION CONGRESS SEEKS TO INJECT MORE IMPROVED METHODS INTO THAT SCIENCE IN STATE

The committee recently appointed at the meeting of the state engineering society held at Boise for the purpose of launching a permanent organization of the Idaho Irrigation Congress, met in that city January 26. The committee is composed of R. E. Sheppard of Jerome, J. P. Congdon of Boise, C. R. Burkey of Jerome, W. O. Cotton of Idaho Falls, and C. C. Fisher of Boise. Since several of the states of the west have already organized either an irrigation institute or an irrigation congress for the purpose of gathering information upon the subject of irrigation, it is only right and proper that Idaho, being foremost in irrigation development, should organize an irrigation congress for the purpose of investigating the errors of the past and perfecting laws which will avoid any further errors. Also for the purpose of colonizing her now vacant lands.

Each member of the above named committee is



Okanogan Project, Washington. Concrete-lined Canal Section, Partly in Rock Cut, at Pogue Flat.



Construction Work in Progress on the Ridenbaugh Canal, Idaho.

appointed to work up interest in the Idaho Irrigation Congress, and the president, R. E. Sheppard, who is a thoroughgoing business man and has made a success of the North Twin Falls Land and Water Company, will endeavor through the year to secure the most eminent authority on such subjects as better financing for the irrigation project and farmers, better agriculture, better stock raising, better marketing and kindred subjects which are vitally interesting to all who are at all interested in the development and up building of Idaho.

It is expected that delegates from the Idaho Irrigation Congress will be sent to represent Idaho at the different irrigation congress meetings of the west and finally to submit a report to the parent congress. The International Irrigation Congress will serve as a clearing house where all matters pertaining to the highest possible irrigation development of the world will be discussed.

FOREST NOTES

During the fiscal year 1916, 705,872 acres of national forest timber lands were estimated and mapped intensively, and 1,093,006 extensively. In all, 20,815,798 acres have been mapped by intensive methods and 47,291,660 by extensive methods.

Investigations by the Forest Prod-

ucts Laboratory at Madison, Wis., have resulted in the use of spent tanbark in the manufacture of asphalt shingles to the extent of 160 tons per week. The value of the bark has been thereby increased from 60 cents to \$2.50 per ton.

There were cut from the national forests in the fiscal year 1916, 604,-

920,000 board feet of timber. Of this amount 119,483,000 board feet was cut under free use privilege by 42,055 individuals. In all, 10,840 sales of timber were made, of which 97 per cent were under \$100 in value, indicating the extent to which the homesteader, rancher, miner, small millman and others in need of a limited quantity of timber draw upon the forests.

NEWS NOTES FROM IRRIGATION PROJECTS OF THE COUNTRY

California

Owing to the high elevation of Chatworth Park, it is impossible to furnish this section with irrigating water from the temporary system of open ditches installed to care for the west end of the valley pending the installation of the permanent pipe system. For this reason Chatsworth will be one of the last points to benefit by the introduction of the Owens river water. A large force of men is now employed in the construction of the Chatsworth high line, which is to bring the water across the north end of the valley from the San Fernando reservoir to the Chatsworth reservoir, and it is hoped to have this line completed in time for irrigation early in the spring.

The extensions to the water distributing system of the Yolo Light & Power Company which supplies water to the large acreage surrounding Madison, have been completed. The canals were necessary to accommodate the increased acreage of rice and other crops needing water.

Rates for water furnished by the Sacramento Valley West Side Canal Company, now in receivership, during the irrigating system of 1917, have been established by the Railroad Commission as follows: Flat rates—for rice, \$7 an acre per year; for all other crops, \$2 per acre; when water is measured the rate shall be \$2 an acre for the use of 1½ feet an acre during the irrigating system, with an additional charge of \$1.50 per acre-foot per annum for each acre-foot used in excess of 1½ acre-foot. The company is to bear the loss of seepage and evaporation between the main and river branch canals and the land where the water is used. Additional laterals are to be constructed at the landowners' expense. The cost of operating and maintaining the laterals is to be borne by the landowners and not by the receiver.

A petition is being circulated throughout the South San Joaquin Irrigation District with a view to changing the method of electing directors. Instead of electing a director from each division it is proposed to have them elected at large, but there seems to be a great many of the voters who do not look with favor on the change. The election of two directors will come before the people in February, when Directors Steinegul and Moulton will have completed their terms of office.

The Cheney Slough Irrigation Company of Colusa has awarded the contract of making many improvements on their property to W. C. Blean. Work will proceed at once on the erection of a pump house sufficiently large to accommodate three powerful

pumps, two of which are already in operation, and another 26-inch pump that will be added.

Work has been started by the South San Joaquin Irrigation District in rebuilding what is known as the Hiltz Sag Flume, one of the biggest flumes in the state, and over 3,300 feet long. The plan is to replace this flume, which carries practically the entire stream of water used for the irrigation of 70,000 acres, with a concrete structure, which when completed will cost something over \$150,000. The original structure of wood cost \$66,000 and is now found to be rotting slowly away. Instead of repairing with wood the district has decided to gradually replace the structure with concrete. The work is planned to span a period of ten to fifteen years.

Colorado

Articles of incorporation have been filed by the National Irrigation Company; capitalization, \$200,000; incorporators, Fred J. Close, C. J. Jones and F. G. Bonfils; headquarters, Denver, Colo.

At the annual meeting of the stockholders of the Cache La Poudre Reservoir Company and the New Cache La Poudre Ditch Company, held recently at Greeley, the following directors were elected: Mort Darling, B. C. Reinks, W. H. Hill, C. B. Tisdell and David Kelley.

At the Sherwood ranch, south of Rocky Ford, over a mile of large tile has been laid, which will conduct the water for the irrigating ditch direct to the land, thereby saving all loss by evaporation, seepage, and it is figured that the expense of the work will be saved in a short time. In the spring many improvements will be made at the ranch, which is one of the finest in that section of the state.

Improvements costing thousands of dollars were begun early this month on the enlargement of the dam of the City View reservoir and irrigation system, located west of Pueblo. With the increased size of the dam the company will be able to store sufficient water for the irrigation of at least 500 acres of land and conserve the overflow water which during the past year was allowed to flow into the river unused. The irrigation system and certain pieces of adjacent property are owned by Asbury White, Samuel E. Davis, B. Bergerman and W. L. Stone of Pueblo. The improvements now being made consist of raising the dam to a height of 37 feet and increasing its length to 300 feet. It will be 172½ feet wide at the bottom and 16 feet across the top. It will be constructed of dirt, with one foot facing of stone.

Idaho

For the purpose of quieting title to water rights on Mason creek and Wilson slough, H. A. Griffiths of Caldwell has instituted a suit against the Pioneer and Riverside irrigation districts, the Farmers' Co-operative Ditch Company and the Federal Reclamation Board. The suit involves the destiny of what is known as the Notus irrigation project, which embraces 5,000 acres of lower Black creek lands. Mr. Griffiths secured a permit to take 25 second feet of water from Mason creek and 50 second feet of water from Wilson slough at points lying east of Caldwell. In the event his action is sustained by the court, it is possible to run a canal to Canyon Hill and then syphon the flow from the Boise river to the west side from where distribution laterals for 500 acres above the Farmers' Co-operative will be constructed.

Directors of the Pioneer Irrigation District for the year 1917 have been named as follows: C. M. Bumgarner of Midway, director; Arthur G. Street of Greenleaf, president of the board; Fred L. Evans of Greenleaf, secretary; W. P. Lyon of Caldwell, treasurer, and E. N. Brown, superintendent.

P. B. Shawhan, manager of the King Hill irrigation project, whose headquarters are in Boise, was in Washington, D. C., recently, where he went to appear in behalf of the state land board before the congressional committee on irrigation projects. Mr. Shawhan was instructed to state to the committee that the state of Idaho was ready to give the government a clear title to its interest in the King Hill project on condition that Congress should advance sufficient funds to put the tract in excellent condition.

An application from the Mountain-home Co-operative Irrigation Company of Boise to sell additional water rights was denied at a recent meeting of the state land board. The board acted on the recommendation of the state engineer, who had in a report advised against the application being granted.

It has been announced that bonds in the sum of \$14,250, being the first installment of the \$365,000 bond issue recently refunded by the Nampa-Meridian irrigation district, have been purchased by the Lumberman's Trust Company of Portland, Ore.

Oregon

The Central Oregon Irrigation Company has filed papers with the state corporation commissioner decreasing its capital stock from \$1,500,000 to \$15,000. Action was taken because the company did not desire to

pay the federal and state taxes on the original stock. The company was organized in 1910 and took over the holdings of the old Deschutes Irrigation Company. It has reclaimed about 86,000 acres of land in Crook county and its bonded indebtedness amounts to \$830,000. The bonds are secured by reclamation liens on the lands, which are owned by the government, and under the agreement the company is to get its pay from the settlers.

The Courtney Irrigation Company of Echo has elected the following officers for the current year: T. G. Smith



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of Echo, president; Will Moore of Pendleton, treasurer and secretary.

Agreement has been reached by the state water board, the desert land board and the Northwest Townsite Company of Philadelphia, Pa., whereby the company is released from obligation under its \$50,000 bond to develop the Paisley irrigation project. Development of the project was blocked by a decree of Circuit Judge Daly of Lake county giving all of the

water of the Chawaucan river to the Chawaucan Land & Cattle Company. It was from the water of this river that the land of the Paisley project was to have been irrigated.

By a vote of 18 to 7 the farmers of Gold Hill and Foothills districts have created the Gold Hill irrigation district. This district embraces about 1,300 acres of land lying in the vicinity of Gold Hill. The cost of supplying water to the land is estimated

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at \$35 per acre. Water will be taken from Rogue river, about three miles above Gold Hill, and will be carried to the land in a ditch about 16 miles long. Work on the project has been commenced and water for irrigation is promised for this coming season.

Texas

The Gulf Coast Irrigation Company has recently been organized, with Walter Hennig of St. Louis, Mo., president; W. H. Ramsey of Bay City, Tex., vice-president. This company has purchased the properties of the Gravity Irrigation & Power Company for a consideration of \$50,000. It is proposed to spend \$50,000 additional for improvements and extensions.

W. F. Thompson, who has a small ranch two miles south of Snyder, Texas, has built a concrete dam across Deep Creek and has impounded a vast body of water, extending a mile up the creek. He will install a pumping plant and will irrigate 150 acres of his farm.

The State Board of Water Engi-

neers has granted a permit to the Leon Springs Irrigation Company, of Fort Stockton, Tex., to store and divert 7,540 acre feet of water annually from Leon Creek Valley for the irrigation of 3,017 acres of land in Pecos county.

Washington

The committee appointed to investigate the proposed irrigation scheme,

by which Ford's, Waunch's and Grand Mound Prairies will be irrigated, has concluded that a private company of farmers would be the best means of financing the enterprise, and with this in view, C. A. Berlin, Theo. Hoss, John S. Saunders and W. N. Beal were appointed to draw tentative articles of incorporation. Each farmer interested will be asked to subscribe for stock.



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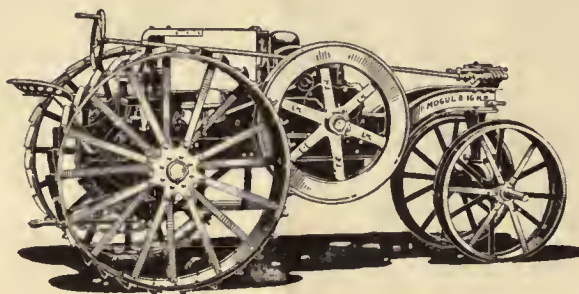
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Thirty-Second Year

THE IRRIGATION AGE

VOL. XXXII

CHICAGO, MARCH, 1917.

No. 5

THE IRRIGATION AGE

With which is Merged

The National Land and Irrigation Journal

MODERN IRRIGATION

THE IRRIGATION ERA

ARID AMERICA

THE WATER USERS' BULLETIN

THE DRAINAGE JOURNAL

MID-WEST

THE FARM HERALD

THE IRRIGATOR

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Official organ Federation of Tree Growing Clubs of America. D. H. Anderson, Secretary.

The Executive Committee of the National Federation of Water Users' Association has taken action whereby THE IRRIGATION AGE is created the official organ of this vast organization, representing 1,000,000 persons on the government irrigation projects.

Continuation King- Graves Debate

The King-Graves debate is continued from our issue of February in this the March number, and is sufficiently interesting to attract the attention of all of our readers, as it covers fully both sides of the question as to whether the reclamation of our arid and swamp lands may be worked out more advantageously under federal or private control. The opening talk in the debate was presented in our February number, and the answer by Judge Graves with the finishing talk by Judge King is herewith presented.

This subject is of such great importance that it will be well for our readers to save copies of the two numbers named and go over the facts presented a second or more times in order that the salient points presented by each speaker may be fully impressed on the minds of those interested.

The AGE will gladly publish opinions from its readers on this debate. Many new facts may be brought out by following this suggestion.

Irrigation District Law for Oregon

In the February issue of the AGE was discussed at some length the then proposed Irrigation District Law for Oregon. This bill, with a few relatively important amendments was passed by the recent session of the Legislature and will become the irrigation district law of that state in June, 1917.

The provision relative to the inclusion of cities and towns in a district was eliminated, as was also the provision relative to the voting by proxy. A correspondent in Oregon judges from a perusal of our editorial in the February number that we had a misconception of the statute relating to the certification of district funds, and he states that this section of the law is copied almost verbatim from the California statute, and that from what investigation he has been able to make the statute has been productive of good results in California.

Our informant further states that this provision does not prevent any irrigation district from issuing bonds but does provide that whenever the condition of an irrigation district meets the requirement of the statute the bonds issued by such district may be certified to by the Secretary of State and bonds so certified become legal investment "for all trust funds, and for the funds of all insurance companies, banks, both commercial and savings, trust companies and bonding companies, and whenever any money or funds may by law now or hereafter enacted, be invested in bonds of cities, counties, school districts or other municipalities in the State of Oregon, such money or funds may be invested in the said bonds of irrigation districts, and whenever bonds of cities, counties, school districts or municipalities may by any law now or hereafter enacted be used as security for the performance of any act, bonds of irrigation districts under the limitations in this Act provided may be so used,

and may also be used as security for the deposit of public money in the banks of said state."

It is believed that this will make a more ready market for irrigation district bonds, including those which cannot be certified under the Act. If a ready market can be established for certified bonds contractors and promoters will be willing to accept the uncertified bonds with the assurance that as soon as the condition of the project becomes such that the bonds may be certified to there will be a market for the same. At the present time there is no assurance that any district bonds may find a market, and it is believed that the provision of the new irrigation district law relative to certification of bonds will do much to change this condition.

The requirement that 25 per cent of the land in the district must be irrigated before the bonds may be certified was eliminated. However, the percentage was changed from sixty to fifty, so that bonds may now be certified only when the value of the assets of the district, when the works are completed, is twice the amount of bonds issued.

This sort of legislation may eventually place irrigation securities on their old-time basis, and should stimulate activity in irrigation work.

Chamberlain-Smith Reclamation Bill A bill to promote reclamation of arid and swamp lands was introduced simultaneously in the Senate and Congress by Senator Chamberlain of Oregon and Representative Smith of Idaho, a full copy of this bill appeared in our issue of February. This bill, if enacted as it reads, is intended, as we view it, to give the Secretary of the Interior power to reclaim both arid and swamp lands, and has nothing whatever to do with what is known as the Reclamation Fund, nor does it have any bearing whatever upon present projects.

This bill, as the writer understands it, is for the purpose of building new projects independent of the present United States Reclamation Fund under present laws, and it will be observed by those who peruse it that in order to come under the bill, an irrigation district must be formed, bonds issued and the bonds turned over to the secretary, who will be empowered to place them on the markets, receive funds therefor and proceed to build the districts with the proceeds under similar rules and regulations and authority as that given the Extension Act. In other words, they will be, in effect, government projects just as our government projects are now, except that the money is to be provided for the projects in the manner mentioned.

This bill, on its face, appears to be a good one,

and should, if it is passed in its present form or with some slight additions or modifications, add greatly to the movement to colonize the Western and Southern States.

One thought has been suggested, viz.: that the time of payment be made longer, and that 1½% be deposited each year as a sinking fund to redeem the entire principal and interest on the amortization plan, or, as others suggest, make the interest 5%, with a view of depositing 2% annually to redeem the entire principal and interest, which would, as we figure it, require between 30 and 35 years.

It appears that the sum of \$500,000 annually would take twenty years to reach a total fund of \$10,000,000, to be used to reimburse the general funds of the Treasury of the United States for any costs, losses or expenses not otherwise provided for, which may be incurred under the provisions of this Act, and should the reclamation guaranty fund ever become exhausted in the payment of obligations incurred under the provisions of the Act, then from such time the sum of \$1,000,000 shall be paid each year out of the receipts of the reclamation fund until such reclamation guaranty fund again reaches the sum of \$10,000,000. The AGE offers as a suggestion the following clause:

Provided, that the Secretary may require the bonds mentioned in Section 3 of this Act to pay 5½% per annum, and on receipt of the interest each year set aside 2% annually as a sinking fund until the par value of such bonds are fully paid, whereupon said bonds shall be cancelled. Provided, further, that the Secretary may, in his discretion, turn the management of such projects over to the irrigation or drainage district, as the case may be, before full payment of the bonds held in the same manner as provided respecting projects constructed by the United States under the present reclamation laws.

These suggestions will be presented to Senator Chamberlain and Congressman Smith for consideration.

Further comments will be made in these columns as the bill progresses, and the AGE will be glad to give publicity to the views of its readers on its provisions as they come to it through the mills.

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**Thoughts
About
Mexico's
Future**

During a recent conversation with three gentlemen all of whom are heavily interested in Western and Southwestern development the subject of Mexico's future was canvassed and various solutions of Mexico's disorder were offered. The fact that each one of these men is prominent in railway construction and colonization work lends value to their opinions.

One of the gentlemen is familiar with conditions in that country—he has built railroads as a contractor, has been a heavy livestock breeder and buyer in all of the best known States of that Republic, and was in touch with the leading men of the Diaz regime. His opinion is that Mexico will never reach a peaceful condition until all of the former leading men of that country who are now exiles in the United States and other countries (about 200 in all) are called together and induced to decide on some man whose honesty, integrity and loyalty to the cause of Mexican rehabilitation is selected and through the influence of this group of men with our Government place this man at the head of Mexican affairs as President.

A move of this character would necessitate an unselfish "get together" movement on the part of the many factions, and it is safe to say that it will be necessary to formulate some such movement before much headway is made to bring Mexico out of her difficulties.

There are several exiles in the United States today who are fully competent to manage the affairs of that country if such backing may be obtained from our Government so that one of them may go to work at reorganization along auspicious lines.

The country of Mexico is richer in agricultural, mining, timber and stock raising possibilities than any similar area within our knowledge. These conditions have indeed contributed largely to her present unfortunate condition through both governmental and commercial influences; perhaps when the whole truth is written it may be proven that the avariciousness of foreign capital (and this includes what Mr. Stillwell is pleased to term "Cannibals of Finance" in our own country) are the original cause of disruption in Mexico.

The writer not long ago visited one of the exiled leaders of Mexico who is now in the United States and during our talks these facts were made prominent.

1. That under the Diaz regime the plan was to encourage commercial cooperation with all the leading nations of the world. The idea being to let

no foreign nation become too influential either commercially or otherwise.

2. That in an equal representation from the various friendly countries Mexico, through contact with these would be in a position to secure without sacrifice of dignity or power the necessary financial aid for railway construction and the development of other industries, which her local banks cannot now furnish.

3. That by contact with foreign countries through their merchant marine a wider and more profitable market would be obtained for the local products of Mexico.

Our informant stated that the European war had so greatly changed conditions that the plan suggested above of equal representation of friendly countries is now out of the question and that the solution of the problem today must come through a closer alliance with the United States. This would give Uncle Sam every opportunity for trade extension in Mexico, and in return the United States would be called upon for assistance in the settlement of present problems—financial aid for rehabilitating their railway systems, and the development of her agricultural, mining and timber industries. The gentleman who outlined the above plan is one of the best informed men in the world on Mexican affairs as they were before the disruption. He is emphatic in contending that Mexico's future is absolutely dependent on her favoring the United States and drawing from the latter both moral and financial aid. The IRRIGATION AGE is not at liberty to divulge the name of the gentleman quoted at present, but the editor hopes to be able to present his views to its readers from time to time. Owing to the fact that nearly all agriculture in Mexico is carried on through irrigation, the development of that country will be of interest to all of our readers.

OWING TO THE IMPORTANCE OF THE SUBJECT UNDER DEBATE BETWEEN JUDGES KING AND GRAVES, IT HAS BEEN DECIDED TO PUBLISH IN FULL IN THIS ISSUE JUDGE GRAVES' REPLY TO THE OPENING TALK BY JUDGE KING AND THE SUMMING UP BY THE LATTER. THIS ARTICLE OCCUPIES MORE SPACE THAN IS USUALLY ALLOWED TO ONE SUBJECT, BUT IT WAS THOUGHT BEST TO PRESENT IT IN FULL IN THE ISSUES OF FEBRUARY AND MARCH. THIS EXPLANATION WILL, WE TRUST, EXPLAIN A LACK OF VARIETY IN THE MATTER IN THIS NUMBER.

DEBATE BETWEEN JUDGE WILL R. KING AND JUDGE CARROLL B. GRAVES BEFORE INTERNATIONAL IRRIGATION CONGRESS, EL PASO, TEXAS



Judge King
Washington, D. C.



Judge Graves
Seattle, Wash.

RESOLVED, THAT ARID- AND SWAMP-LAND RECLAMATION CAN BE UNDERTAKEN MORE ADVANTAGEOUSLY BY GOVERNMENT ACTIVITY THAN BY PRIVATE ENTERPRISE

(Continuation from February Issue)

Judge Graves Takes the Negative

Judge Graves: Mr. Chairman, ladies, and gentlemen. A glance at the map of the North American continent will show that these United States constitute a huge parallelogram, extending north and south approximately 1,500 miles and east and west 3,000 miles, bounded on the south by the semitropics and on the north by the semiarctic regions; bounded on the east by the restless Atlantic and on the west by the constant urge of the mighty Pacific.

In the very northwest corner of that parallelogram lies the state of Washington, and I came here, traveling the last few days by rail and car about 2,500 miles, to discuss this question.

The people living in the western part of that parallelogram, comprising over one-half of the territory of these United States, yet to be reclaimed or dependent on the reclamation of the lands, are vitally interested in these momentous questions. As I traveled my mind wandered into the quiet corridors of memory and I recalled that the distinguished chief counsel for the Reclamation Service and the very eminent lawyer who just addressed you was so fortunate as to be born within the limits of the then territory and now state of Washington, and he is one of the treasured recollections we have of the young men who have gone forth from that state. I have the honor of being only an adopted son of that state.

There was some suggestion that this debate was to have two debaters on each side; in fact, the telegrams that I received from your distinguished president and the efficient secretary of this congress led me to believe that when I came down here there would be somebody to assist me in sustaining this negative, and that the whole burden would not be thrown upon me, but here I have to meet the onslaught of Judge King alone and unaided; but I have the consolation of remembering that it is related that the humbler knights of England, though they knew they were going to be overthrown, yet esteemed it an honor to break a lance in the lists with King Richard Coeur de Lion, and so if I go down in defeat in this argument it will be with honor to myself. (Applause.)

The distinguished counsel for the Reclamation Service has debouched into the realm of figures, but I may not follow him there; I have not those figures at my command; I have not the statistics, and I can not argue

from them. But I do know the utter valuelessness of them.

It was Zeno, the Sophist, of Greece, of the School of Sophists, who sought by figures and by logical statements to put to rout the most fundamental principles upon which men formulate their action. It was Zeno who said that to take a hare and a tortoise, and assume that the hare will progress ten times faster than the tortoise, and give the tortoise 10 miles the start of the hare, can the hare ever overtake him? He said when the hare has gone 10 miles the tortoise will have gone 1 mile, and when the hare has covered the 1 mile the tortoise will have gone one-tenth of a mile, and so on ad infinitum. By his figures nobody has been able to disprove that, but our own senses know better. (Laughter.)

And when Judge King here says to you that these reclamation projects do not cost the settler anything and that they are a success, and sustains his statement with figures, I can not combat them, but I know by my own senses and by my own experience, and every man who has lived on one of them knows, that they are not a success, as he says they are. Now, that is all there is to it, and we might as well approach the subject from a different angle.

Now, what I am going to say, mark you, ladies and gentlemen, is not by way of criticism of any individual, nor yet of any officer. It has been my reward, beyond all merit, to be brought into close touch with many of the officers of our government. I have found them high-minded, high-purposed, men, but the measure of policies controls in such matters, and not the measure of men; the urge of a certain policy, the demand of certain economics, overreach and overwhelm the purposes of any man, however honest or however able he may be.

You will pardon me if I now turn to something which I have set down with a reasonable amount of care, so that I may not be misunderstood in this discussion, and that is, that in the consideration of this question, whether the work of reclamation—and I shall consider it largely from the standpoint of the reclamation of arid lands rather than the reclamation of swamp lands, although that will be considered incidentally—may be best advanced through government activity or by private enterprise, there must of necessity be some preliminary definition and certain limitations placed upon the scope and range of the subject, and

certain factors must be conceded and assumed.

We shall, for example, assume that government activity is not to be restricted to the reclaiming of public lands, and shall concede for the argument that the United States may invade and occupy the province of privately owned land reclamation without constitutional limitation or inhibition. Upon the other hand, we shall define the question to mean, and assume that the term "private enterprise" means, all forms of activity not comprehended in the expression "government activity," and to include the enterprise or activity of private persons, either individually or in association, private corporations with public obligations, as well as quasimunicipal organizations, formed by private landowners under state laws, such as irrigation districts and drainage districts.

Government activity has heretofore been employed through the agencies created by the reclamation act and supplementary legislation, and it may safely be assumed that it will continue along similar lines. In private enterprise, work has heretofore been carried on, first, by the individual or in association with his neighbors, being the ideal and most satisfactory method yet employed, where feasible; second, by the mutual water corporation, in which the shares of stock represent interests in the water and not money dividends, and in which the corporation is under no obligation to render service to others than its stockholders; third, the well known business corporation organized for profit, performing given public duties, and subject to public regulation and state control; and, lastly, by a public or quasi-municipal corporation, authorized under state law, vested with the taxing power, and exercising local control and regulation as distinguished from governmental, departmental, and bureau authority, and of which class the irrigation district is best representative.

Beyond all doubt the days of small things and independent modes of life are the happiest estate of man. The early settler and small farmer, enjoying a condition where the water and land were adjacent, had only to draw upon his own efforts and means to unite the water and soil and the chemistry of nature did the remainder. He was unhampered by restrictions, assessments, high charges, or heavy financial burdens. The fact remains that those conditions have changed, that nearly all the easy and small projects have been utilized, and that large bodies of arable land with dis-

tant sources of water supply demand concerted and associated effort with assembled capital of large sums. The situation was first met by mutual associations of water users, incorporated or unincorporated, as deemed most feasible.

The private corporation for profit also entered the field and some of the most ambitious undertakings with which we are familiar were launched under that form. That some of them were failures because of an attempt to reap huge gains is undoubtedly true; and that many of them failed because of ill advised conception of the plan and a belief that the land and the farmer could bear and discharge almost inconceivable financial burdens is also true. But this last thought is applicable alike to private, corporate, district, and government plans. We have learned a great many things about irrigation in the last few years and the most important lesson is that any project under consideration must be sound from agricultural, engineering and financial standpoints or else the undertaking is doomed to failure from its inception. I make the assertion without fear of successful contradiction that in large irrigation enterprises, given a well conceived and feasible plan and sufficient capital, a private water corporation will give the most efficient service and the least dissatisfaction to the water user and at the most moderate charge of any of the larger agencies; provided it is placed under proper state supervision and control. Its efficiency and service then rank with other great public utilities under like supervision and control, such as light, traction and rail utilities.

But after all, ladies and gentlemen, I am wedded to that system of private enterprise in reclamation projects and its methods of regulation and distribution provided by our state irrigation district acts and district drainage acts. Those acts and the theory of those acts are entirely in accord with the spirit of our institutions.

Let me briefly recite—in case any one here has not complete knowledge of the subject—how we form a district, for we operate nearly the same in irrigation districts as in drainage districts. The plan is first conceived; and then a petition is made by the land owners asking to have all the lands which are supplied by a common source incorporated as a district. The county court—whatever may be its name—considers the petition, and if it deems it a proper one, submits it to a vote of the land owners of that district or of that territory, and they vote upon it. In most of our district acts two-thirds are required to incorporate; in many of the drainage acts, only a majority. After that has been done by one of several methods the cost is estimated, and then the directors or supervisors of the district submit that question to a vote of the land owners, and if there is a majority of the vote in favor of issuing bonds in the estimated amount, the bonds are issued and sold.

After the bonds have been voted a proceeding is brought in the court having jurisdiction, and all questions

regarding the validity of the district, the validity of the bonds, and the validity of the inclusion of the land are passed upon, and when the court has approved all the proceedings, the bonds are entirely valid and can never be attacked again. Then the water is distributed by the directors, elected from among the people of the district, and the payments are made upon the basis of the benefits conferred upon the land and the bonds are paid for by assessments levied upon the land and collected.

In most of the irrigation districts the construction costs are paid for by a 20-year bond, and the first 10 years the bonds only draw interest; at the end of 11 years you pay 5 per cent of the principal, and the next year 6 per cent, and so on until the end of the 20 years, when the whole principal is paid off and the debt is discharged.

Now then, ladies and gentlemen, I have no objection to our government—our federal government—invading the province of the people to the extent of building these large storage dams about which Judge King has spoken. That is not government activity any more than it is activity on the part of the government to dredge your harbors and build your ship canals, but when we come down to the proposition of exercising that activity in the intimate fields of endeavor, which ought to be performed by private business concerns, we overshoot the mark and pass beyond the proper power of any officer of the government.

I would not object to the mere building of storage dams, and yet, that brings a great cost upon the people.

I was struck by one thought when Judge King was talking. He spoke about the Roosevelt Dam; it is a magnificent dam—a great concrete structure, but what does it do? Why, when the officers of the Reclamation Service went into that valley they found remnants of canals built by a prehistoric people, which, by gravity alone, irrigated 100,000 acres without the aid of any magnificent concrete dam, the cost of which is to be charged back to the individual acre.

I am opposed to government control and government supervision, and government intrusion and invasion of immediate reclamation work, because they tend toward peasantry and official peonage, and toward the de-thronement of the independent farmer and the staunchest of American freemen. I am in favor of private enterprise because it tends to instill and maintain in the manhood of this country that independent character which has heretofore made the men from the farm the chief bulwark of this nation in times of economic and political stress, and on all her fields of glory to the present day. Amidst all the contentions of policies and storms of war the farmer has ever stood unbending, like the "unwedgable and gnarled oak."

We admire the genius and glitter of war and are stirred by the passion of patriotism. We acclaim the bright tradition of the sword of Wallace and the leadership of the dauntless Bruce that come to us from the heathered

hills of Scotland. We are thrilled by the intrepid spirit of France, fighting under the lilies of her kings, the eagles of Napoleon, or beneath the banners of the regnant republic; and we do not forget the Fatherland and its River Rhine of story and of song. We reverence England's sculptured Hampdens and Nelsons and all her truly great, and the proud memories of our own great and peerless soldiers and sailors, and yet it is the boy from the farm who is the mainstay of the nation. [Applause.] The man who cultivates his own acres, builds his own home, and is attached to the soil by ties of family and affection is the firm rock to which the institutions of our communities and the hopes of state and nation must ever be anchored. The "embattled farmers" stayed Britain's power at Lexington and their shoeless feet crimsoned the snows of Valley Forge; and it was the great Washington, coming from the fields of Mount Vernon, who safely piloted the colonies through the storms and whirlpools of war and revolution. [Applause.] It was the boy from the North who made the cause of the Union triumphant, and he came from the farm; and it was the boy from the southern plantation who upheld the falling fortunes of the South. It was Lincoln, the immortal Lincoln, product of the farm, who was and who is typical of all that is best and greatest in our national life; while the unrivaled Lee, from the fields of Virginia, represented the ideals of the South and was her great and peerless commander. [Applause.]

On Dec. 9, 1914, there was introduced in the Senate of the United States bill No. 6827, and since reintroduced as Senate bill No. 1922, entitled "A bill relating to the reclamation of arid, semiarid, swamp and overflow lands through district organizations and authorizing government aid therefor." The genesis of this proposed legislation is somewhat as follows: In April, 1914, upon the initiative and invitation of Secretary Lane a conference was held in the city of Denver, Colo., for the purpose of discussing federal and state cooperation to further irrigation work. This conference was largely attended by delegations from all the states interested in the subject and by many officers of the Interior Department. The Washington Irrigation Institute indorsed a plan submitted to it by Mr. E. W. Burr of North Yakima, and myself that federal aid be obtained by government officials examining any irrigation district project, and if it were found feasible, the United States to purchase one-half of the bonds to be issued, and the other one-half of the bonds to be offered for sale to private purchasers; it being believed that the United States, having taken one-half of the bonds and having certified to the good character of the project, the remaining one-half of the bonds would find ready sale. I was selected to propose that plan to the Denver conference, and the plan so proposed, at the time, met with approval. Later, in the city of Washington, I took up the matter with certain government officers, and also with some senators

and representatives' from various states, and soon found that the plan of the United States purchasing one-half of the bonds would, in all probability, never receive the sanction of Congress, and the present Jones bill was then substituted for the original plan.

The dominant and salient features of that bill are these: The district law, as it exists generally throughout the Western states for irrigation purposes, and as it exists in many of the states for drainage purposes, is to be employed in the plan. The district is to be the unit upon which the legislation is builded, and it is to be the agency employed in carrying on the work of reclamation. The bonds to be issued by the district shall run for a period of 40 years and shall bear interest at the rate of 4 per cent per annum. Whenever any district shall desire the cooperation and aid of the United States, it shall file with the Secretary of the Interior plans and estimates of the work proposed to be done, and apply to have such plans and estimates examined and approved. The Secretary of the Interior shall then cause an examination to be made of the plans and the district project, and if the same shall be deemed feasible or be modified so as to become feasible, the Secretary of the Interior may, on behalf of the United States, guarantee the payment of the interest on the bonds to be issued. It is also provided that any irrigation project which has been completed under the reclamation act, or in which construction is under way under said act, or which has been authorized under the provisions of said act, may be organized under the district law and be entitled to the rights and privileges granted in such cases. I may add that Judge King, representing his personal views, and not speaking for the department, has approved the general outline of this bill and the main features of that plan.

In order to take advantage of this federal legislation, if it should be passed, each state must pass an act providing for acceptance of this federal aid. It is contemplated that such state act shall provide for 40-year 4 per cent bonds, and that during the first four years no interest shall be collected from the land owner, but such interest shall be provided for by a sale of a sufficient quantity of the principal bonds to meet these first four years' interest charges. Commencing at the end of the eleventh year, an additional charge shall be made of 2 per cent each year thereafter, this 2 per cent to be deposited in a sinking fund and to be invested in some form of good security bearing not less than 4 per cent interest. This fund, invested each year at 4 per cent interest, compounded, will at the end of the 40 years, pay off the original bond issue. The investments should be made only in those securities which are made a matter of investment for the common school fund of the state. That is, the situation would be, that during the first four years the water user would pay nothing, for seven years he would pay 4 per cent interest per annum, and for 29 years he would

pay 6 per cent, and the principal would be thereby retired at the same time. The state of Washington, in the legislative session of 1915, passed an act of this character in anticipation of favorable congressional action.

That is not national activity.

The national aid so extended is not government activity, but government aid. Assuming and conceding the constitutionality of such legislation, it is as much a just measure of government aid as that given in the improvement of rivers and harbors for the advancement of commerce. Such aid can not be classified as government activity, because the principle of local government and local regulation of distribution is preserved, and because the federal government will be relieved from appropriating or collecting and expending princely sums and stupendous resources, and there will cease that inevitable friction and sullen dissatisfaction arising where federal officers and local users are brought into direct and immediate contact. I am opposed to federal initiative and departmental work in the reclaiming of land for agricultural uses and the consequent assumption of power and control over the greatest public resources remaining to the people upon two grounds, which appear to me to be insuperable objections to the extension of federal authority in that direction, although there are others which may be urged. Those two points are:

(1) The excessive cost, chargeable back to the land itself; and

(2) The plan is against good national policy.

The lamp of experience has always lighted the pathway of the future, and one who would lay a safe course must be guided by the unerring and undying lights which burn upon the hill-tops of the past. We know, without statement or argument, that the expense of governmental work exceeds its fair cost. This appears in all the multiplied activities and improvements undertaken through federal intervention which go beyond the exercise of the pure governmental functions. This statement is not made by way of criticism, necessarily. I am content to merely recite the fact. There are many causes and reasons for the undeniable fact. In the forming of this nation the makers of the Constitution only intended to fix the political and civil rights of the people, and provide a government to uphold, protect and enforce those rights within certain granted limits. Whenever the general government goes beyond those purposes it attempts to exercise powers with which it is not endowed; and in entering the unrelated fields of social, economic, and business affairs it is in a situation where its political organism does not function properly.

The department expenses, the overhead charges, the maintenance of a bureau in perpetuity, and the employment of a small army of officers—all apparently necessary or desirable in federal work—added to the cost of actual construction and administrative work on the ground, aggregate a cost which the land in the average reclamation project can not bear. The ob-

jection of great cost would not be conclusive if that cost was to be borne by appropriations from the national treasury and paid by revenues derived from indirect taxation, as in the case of other public works in aid of the general good and welfare, but when all of the above enumerated expense is charged back against the land, to be paid by the toil and effort of the individual, either the burden is too great for the settler and farmer with home and family obligation or else he is reduced to a life of bondage that differs from servitude in denomination alone. The controlling thought and the commanding factor in all reclamation projects are to make the cost and operation as tolerable as human judgment will permit, so that the land to be reclaimed may bear the load easily and without strain; and if experience and past ventures are to be relied upon, this can not be accomplished through federal agency unless a generous congress, acting within constitutional limits, shall donate enormous sums without provision for reimbursement—a conception which is, in our time at least, wholly chimerical and without practical value. Let local and private enterprise proceed with discretion, even if large developments must delay for a time, and be aided by such federal credit and guaranty as will make these private and district securities both desirable and stable.

In our own state of Washington, in one county, there are two irrigation projects comprising approximately 10,000 acres each. I beg your pardon—I am dropping, just like my distinguished friend on the other side, into the realm of figures, but I shall not proceed long. Ten years ago one of these developments was commenced by the United States, and today only 5,800 acres, or less than 60 per cent of the project land, is under cultivation, and the cost per acre for federal charges at last reports had mounted to the sum of \$110. The other territory was organized into an irrigation district, and that organization was completed and its bonds voted in 1915, and in May, 1916, water was turned into the canals, and today 50 per cent of the lands are in cultivation or ready for planting, and by the spring of the new year the whole area will be prepared to receive water, and all this at a cost of \$60. Each water supply was originally estimated at \$60 an acre, and the privately operated district undertaking kept within that estimate, while the government project has run 40 per cent higher and 40 per cent of the acres in that project are still waiting tillers, and will wait a long period unless some means are devised to reduce the acreage charge.

I know of another county in our state where the main irrigation has been had through corporations, and by some use of the district system, but no government canals are operated. In that locality each farmer owns in his own right at least 160 acres of land without let, incumbrance, or mortgage, free from foreign supervision of any character, and has cattle in his fields, produce in his barn, money in the bank, his children in the

schools, contentment in his home, and happiness in his heart. No government built and operated scheme can ever, proximately, rival this result.

There is another section where lie 400,000 acres of fertile land, dependent upon a single source of water supply. This plan is feasible from every viewpoint, notwithstanding some difficult and daring engineering features, and can be put through at moderate cost by private corporation or district corporation, and this will be done. But I can see, with great clarity of vision, that if the federal government should ever assume to appropriate the water supply and build works for the reclamation of this great territory—a principality in extent and promise of wealth—then its future will be clouded, its development retarded, and its future settlers compelled to struggle with project obligations.

Dr. Elwood Mead, who took part in the discussion at this congress a year ago, bore eloquent testimony to what I have stated about these project obligations, and during the course of that discussion he said, "I have said that the conditions of the settlers about these works called for relief. On one project the average indebtedness of each of the settlers is \$1,000; they have exhausted their capital, reached the limit of their crop, and have no way to complete the improvement of their farms. On another project, three-fourths of the settlers must lose the fruits of years of effort and all the capital spent in the development if it is not soon forthcoming. On another project, 85 per cent of the farms are mortgaged, and the mortgage debt averages \$50 per acre over the whole area, exclusive of project obligations. On another project, one farm has been sold, abandoned, and resold five times."

Those are not my figures; they are not Judge King's figures, or, at least, he did not favor us with them. Perhaps he did not have them. But those are the facts, as testified to by Dr. Mead.

We may say that as to drainage work that there is a uniform district drainage law in the middle west. Six states, I think, have the same act. The act originated in Missouri, and the states of Missouri, Florida, Mississippi, Ohio, Indiana, and Connecticut now have this law. Modified forms of the same act exist in Kentucky and other states. Let me say to you that Missouri alone has eighteen millions of bonds and finds a ready market for them at from 5 to 5½ per cent interest.

Why should government authority invade a privately operated drainage district such as they have there at those prices?

I want to turn to the question of the policy of government activity, and in doing so we must take higher ground and obtain a broader view. We must pass from questions of mere expediency to matters of national policy and the basic facts upon which rest our peculiar institutions. I am an old fashioned believer in the Constitution and the principles upon which it is founded. I do not favor

following the streams of authority and precedent into somber forests of the past, but I do adhere to the construction given the great charter of our government by the writings of Hamilton and Madison, by the arguments of Webster and the decisions of Marshall. That great instrument was designed to and will, if preserved, protect those rights which were wrested in times past from the ruthless and reluctant hands of power, and which come down to us through the throes of revolution and the fierce fires of rebellion. The freedom of the individual and the liberty of a nation are generally lost or impaired by insidious and not well recognized approaches.

Those holding positions of power are not always to be blamed for their aggrandizement of that power. They may be mistaken or be the creatures of the system by which they find themselves surrounded. Officers come and officers go, but the system, organization, bureau and department ever live, and if they are not confined in their proper channels they ever widen their power and influence. The insistence of the people themselves that matters of great moment—the great projects for instance—shall be waived in favor of temporary demands, in the past, has led to the weakening of many vital public safeguards. The liberty of a people, like the virtue of the individual, must be guarded not alone from assaults from without, but must also be protected from its own impulse to yield to the lust of power.

The ordinary citizen is bewildered by the increase in the activities and powers of his general government. He is familiar with the policy and spirit of our institutions, rightfully declared by the fathers and carried into the Constitution, that our general federal government can not and should not be a democracy—that the exercise of those democratic powers were reserved for state and local communities; but he still believed that this government was republican and representative in fact as well as in form. He is gradually coming to realize that there is also a passing away of our republican or representative form of general government, and that a return is being made to powers and methods in which he has no voice and over which his representatives exercise no control. He may well stand aghast as he views the increasing numbers of departments, bureaus, boards, and commissions, and the great army of officers and employees which the widening powers and activities conferred upon the administrative division of our general government have called into being. Not only is the number of these offices and officers being added to, but in a geometrical ratio their importance and influence upon the lives and affairs of the people of the nation are increased. If one would seek the senator or congressman from his own state in the nation's capitol he discovers that such a representative is not only difficult to find in that world of officialdom, but that also his influ-

ence is in a descending ratio, and that even the still small voice of the judiciary—the third great department of our Constitution—is almost lost in the swelling chorus of administrative officers, who assume to exert judicial as well as administrative and legislative functions.

It may seem that I have wandered far afield, but such is not the intention and is not the fact. We are discussing questions of policy now and not of law, and I desire to emphasize the point that if we once open the door for encroachment of federal authority we shall let in a multitude of evils. Once admit the principle that the general government may deal with and supervise the affairs of the citizen on his social and business side, and you have taken a long step towards official autocracy which points toward that absolutism and paternal powers in government which we must ever abhor. I know of no more absolute grant of power than to grant to the federal government the authority to withdraw and sequester all sources of water supply in this great West, to build all work for reclamation, to supervise all distribution of water and to make such charge for the service as may be designed and computed at Washington. Such a course is tantamount to reducing communities to a condition of tenantry, stifling all individual initiative, and making each person affected a dependent upon the gratuity of a bureau of the government. The slavish portion of the reclamation act, requiring residence on or near a very limited tract, has driven many a settler from the proposed project, and fitly characterizes what further laws and regulations will be imposed if private enterprise is forever exiled from this work and government occupation acceded to. Why condemn the feudal lord who refused his vassal the privilege of leaving the baronial lands and villages and denied him the privilege of earning more than a bare existence for himself?

No, we can not afford in this western country to tie ourselves to government control. It is through the individual and the community that development must be made. One-half of the territory of the United States is wholly or in part dependent upon irrigation of the soil for successful agriculture; and any man who gives his energy, his time, his efforts, and his best thought to building up the irrigation systems and irrigation laws of this vast West, lends himself and connects himself in name, fame, and character with that which is and must be not only as durable as our form of government, but probably as lasting as the frame of human society.

I thank you. [Applause.]

Closing Argument by Judge King

Judge King: Mr. Chairman, ladies, and gentlemen, none of you has listened with more intense interest than have I to the distinguished orator who has just addressed this congress, and I assure you that I have been much entertained by the glowing scenes reflected upon our debating

canvas by the shining light with whom we are honored from the state of Washington.

I have long since noticed, however, that the most eloquent orators are, as a rule, on the wrong side of the question presented. We do not need orators on the right side. All we need is someone who, in an humble way, may turn on sufficient light to enable us to see the points involved—the people do the rest. [Applause.] But when we get on the wrong side of a question then the more oratory we use the more we cover up our tracks. [Laughter.]

I have not placed my remarks in writing, as has the judge as to much of his address, and consequently have overlooked several good points which I intended to mention in my opening address, but it will not do to mention them now, for there is a rule of ethics among lawyers and debaters that one must present his whole case in the opening statement and confine the closing remarks to answering the opponent.

The distinguished gentleman who has just spoken tells you that we can prove almost anything by figures and gives us the hare-and-the-tortoise story. We are neither hares nor tortoises on this occasion. [Laughter.] When it comes to figures he at first steers clear of them. You know there is a rule recognized by everyone that figures will not prevaricate. You will therefore understand why my opponent wants to dodge them. [Laughter.] But Judge Graves finally forgot himself and fell back upon "figuristic" logic himself. In nearly 25 years' practice of the law I have found that it is human to tell the truth. If a witness upon the stand tries to mislead you, tries to cover up the truth, it is because of some motive in his mind, but if you catch him off his guard, when the motive is for the moment lost, he will unconsciously tell the truth. To tell the truth is natural; to falsify requires an effort. Now, it seems that Judge Graves finally forgot himself on this occasion and actually used figures; he accidentally let out the truth with them. [Laughter.]

The judge picks out specific instances to prove that a reclamation service project in a particular case cost more than a certain private project over across the line. We can prove anything in that way. It is a case of reasoning from a special instance to a general rule, which no test of logic will uphold. We can pick out special instances and prove the contrary; we can pick out hundreds of cases in the United States—and when I say hundreds it is no exaggeration—where private projects cost from \$30 to \$60 per acre, and up to \$125. A private project in the state of Washington, for example, cost \$100 per acre, about one-half of which will go as profit to those who build the project and which must be paid by the settlers on the lands. While under the government projects the entire profit goes to the settlers who pay the bills; the government receives no profit, the settlers receive it all, but under projects using private

capital, a large profit must be received, which, in part, accounts for the excess cost on private-capital projects as compared with government projects where no profit is demanded or received.

There is only one safe way to estimate this question of cost, and that is to take a given number of projects, as we have done—fifteen, say, of the largest projects on each side—and average them up and see what they cost. I am not asking you to take my word for it; you can get the statistics and figure it out yourself. When you do so you will find that, on an average, the government projects cost less than \$50 per acre, while the projects constructed with private capital cost more than \$60 per acre, plus interest, which, in the end, more than doubles that sum.

The trouble I find in much of the judge's argument is that he, to start with, assumes a premise which we do not accept, but which, if accepted, must lead us to his conclusion. He tells you that he does not want to see the government given the power to withdraw all the sources of water supply; he does not want to see the government given the power to control all the irrigation in the United States, etc. Neither do I. Neither do you. Nor has the government undertaken, nor have any of its agents or officials in the United States Reclamation Service advocated anything of that kind.

There is nothing in connection with the reclamation service or its policies that prevents any private enterprise from reclaiming land wherever and whenever desired; in fact, reclamation by private capital has been encouraged by the service. At least I know this to have been the situation during the last four years. The sad and painful feature of it is, however, that usually when such reclamation has been undertaken, the interested parties have finally called upon the reclamation service begging that we take the matter off their hands. And in many cases the bondholders are willing to sacrifice hundreds of thousands of dollars of their investment in order to get us to do so.

There is one peculiar inconsistency in the argument of the gentleman who has just addressed you, and that is, he does not believe in the government entering upon the irrigation of these lands, and yet he is perfectly willing and anxious for the government to loan its credit to the extent at least of guaranteeing the interest on irrigation district bonds, or even a large part of the principal, in order to aid irrigation districts in the building of these projects to which he refers. He is willing for the government to assist if Uncle Sam will only permit the districts or the citizens to receive the benefit of such assistance without having any right of supervision over them. This, he says, is not government "activity," but government "aid." But where is the difference? It smells as sweetly under one name as the other.

He referred to me as having spoken before the senate committee in favor of what is known as the Jones' bill,

which embodies the plan I have just mentioned. I will admit that I did speak in favor of the general principles presented by that bill, but there is not a word in the report of my argument, which consumed the forenoons of two days, from which it can be inferred that I favor the government guaranteeing either the bonds or interest and at the same time permitting the private or municipal corporation, as the case may be, to have absolute control of the project, and of its distribution and management, including the disbursement of the funds, etc.

But I do believe in the principle of the government guaranteeing the bonds, principal, and interest, and so stated in my argument, provided the work shall be done under government supervision; that is to say, the projects must be built and remain under government management until at least one-half of the funds are repaid. And in my argument before the senate committee I intended clearly to say so. I made the remark that I favored the general principles of that bill, but that there were many things in it which I did not favor. Senator Jones, who was its sponsor, replied: "We are not sticklers for this particular bill as it is. What are your suggestions? We are willing to have it amended." I then gave my views in a general way as to how it might be amended, which included government building and control until the investment should be deemed safe.

I make this explanation that it may not be inferred that I believe in the government guaranteeing payment and at the same time leaving the management to private enterprise without the supervisory control of the United States. I am both for that bill and against it; it just depends on how it is amended, and I think before we get through Senator Jones, of Washington; Judge Graves, of the same state; and I will not be far apart. I think all of us will finally "wind up" in favor of the government supervising the matter to the extent of the building of the project and the disbursing of the funds and maintaining control over them until after the greater part of the indebtedness is paid, just as it does on projects constructed under the present reclamation laws.

We are told by the speaker who has just addressed you, as I understood him, that it might be better for the government, out of the general fund, to build irrigation projects just as it dredges the harbors and rivers. Now, ladies and gentlemen, there is a vast difference between that class of public works and the reclamation of arid lands. When you dredge or improve a harbor or river the boats of the entire world may float into that harbor or upon that river. It is the property not only of the United States, but to a large extent of the whole world. But when you reclaim a farm and turn it over to an individual, upon that land its owner is the "monarch of all he surveys," and he can prevent any trespasser from coming upon it. But not so with rivers and harbors. The

distinction is therefore apparent. It is, of course, true that the government receives a benefit from irrigation projects; that in reclaiming the arid lands of the West it is building up a population in cities and towns and homes which, as time goes on, will be able to repel an invasion from a possible enemy if such a calamity should ever happen. To that extent, together with the increase in the financial resources of the nation, the increase of taxable property of its states, and the providing of homes for overcrowded sections, the government does receive a general benefit and to that extent the government is interested, but the immediate benefit is to the individual. And Uncle Sam is meeting you half way; he is furnishing this reclamation money to you without interest; he is building the project for you as individuals, not for the use of the whole world or any great part of it, and in that way he guarantees the success of the project; and you as individuals receive the immediate exclusive benefit of it. Such conditions do not prevail in the case of rivers and harbors. The error in comparison is therefore manifest.

While Judge Graves is willing for the government to use its money and build these reservoirs, and tender them to the settlers free of charge, his general policy, and that in which he believes the more, is to let the corporations build them, although, as I endeavored to demonstrate to you a while ago, those furnishing the private capital usually make half of the profit themselves. Our good friend, the judge, is perfectly willing to let private capital build the projects and assess upon the water users 6 per cent interest for 20 years, or \$130 per acre for a \$65 water right. That is his choice; that is the policy which he tells you he stands for; that is the policy his side of this debate is advocating. I am not saying that he admits my conclusion, but that is the logical effect of his position. He would not seriously object if the government were to make you a present of the works, but he would prefer, as I take it, that the government would not do so, but that the corporations build them and charge you interest and profit along the lines and in the manner mentioned. That plan will seldom succeed. We do not stand for it, and as time and experience go on it will soon be said, "We never will." [Applause.]

I learned this evening that I am to be placed upon the program for a 20-minute talk tomorrow afternoon to tell you how I think the government should venture into reclamation work so as to include both arid and swamp lands in the field of its efforts, and in place of reclaiming less than two million and a half acres, as has thus far been done, we will reclaim one hundred million acres. [Applause.] This reclamation, if accomplished, would, in itself, make a great commonwealth, a state as large as Montana, Rhode Island, Delaware, and Connecticut combined. We have something like 75,000,000 acres of swamp land, besides more than 23,-

000,000 acres of unreclaimed desert, and it would require an investment in the neighborhood of a billion dollars, if not more, to accomplish the work. This proposition is not directly germane to the question in hand, but I pause to observe that if the government can not do this great work, it is practically certain that private enterprise can not. But there is a way by which the government can do it, and do it easily, of which I shall speak tomorrow. It is not properly a part of this debate.

We are told by Judge Graves that he has no objection to building these great reservoirs for reclamation of the lands, such as I enumerated, but he objects to Uncle Sam invading the province of private enterprise. Now, that includes an assumption to the effect that we are depriving private enterprise of the right to build projects. This is an erroneous assumption. As I have stated, there is no objection to private enterprise going ahead, but at the same time the government should also go ahead and build these great projects. Neither need necessarily wait for the other. Uncle Sam has no objection to private enterprise proceeding whenever and wherever desired. If the people want to bear the burdens and act independently, Uncle Sam, in his goodness of heart, always stands ready and willing to look on in silent contentment.

My opponent's verbal painting of the picture of the light of private enterprise shining from the hilltops of individual effort is inspiring. The thought is beautifully expressed, but we must remember that it is a condition and not a theory with which we are confronted. Anyone can stand and look with awe upon a picture, but let the same person sit for the picture and perform the acts represented, let him be not the picture, but the actual performer, as in this case the farmer; or if it be a battle, let him be one of the soldiers; let him experience the blunt reality instead of gazing upon an idealistic presentation; then the romance and allurements will vanish, and the cold, logical facts will prove to be the real and effective instructor. [Applause.]

As I said in the outset, when it is conceded that practically all the available streams subject to use and diversion and successful operation by individuals and small bodies of farmers have long ago been taken up, and when it is not disputed that corporate enterprises have about reached their limit, then to concede, as Judge Graves has, that perhaps the government should go ahead and build these great reservoirs and dams (and guarantee part of the principal and all interest on district bonds) is pretty nearly conceding away his case. For this resolution, to the effect that the government can more efficiently and more successfully reclaim the arid and swamp lands, refers to the future, and not to the past. It is not questioned but that investors of private capital along these lines have about reached their limit; they can only handle reclamation on a small scale and outside the building of these

large reservoirs such as have been mentioned.

Judge Graves tells us of the glowing success of the farmers prior to Uncle Sam's entrance into reclamation work in Arizona; that they had 100,000 acres under irrigation in Maricopa county in that state (yes, "Maricopa," that beautiful sounding name), before the government took hold of the project. I do not know the exact acreage, but I suppose that is true. But we have now nearly 200,000 acres, or at least water enough for approximately that amount. And, as stated before, the taxable property during a period of 13 years has increased from \$9,000,000 in 1903 to \$75,000,000 at the present time. If the private enterprises he mentioned were successful, or more successful than the government enterprise, why is it that in all the history of that county, covering a period of more than a quarter of a century—yes, I might say a period of 300 years (we might at least go back to the time when "the stars fell")—the county only reached an assessed valuation of about \$9,000,000? Yes, why? Let echo answer, Why? The gentleman who has just spoken has not answered why, where, nor from whence comes this change.

There is a further fallacy in his able argument, when measured from the angle from which he views it. He puts the matter on an acreage basis, without taking into consideration the character of the irrigation, the source of the water supply, the efficiency of the irrigation, or the productiveness of the lands under the system. Suppose, for example, the water users could raise the three crops of alfalfa on the hundred thousand acres which the judge has so glowingly pictured from the hilltops as being irrigated before Uncle Sam with his big shoes began to tread upon the poor farmers in that section. Did it prove more successful than the raising of six crops under the present system? Or, if that early system were sufficient, can anyone explain why every citizen in that county was anxious to have the benefit of a government water right or why they still want to build more projects, the Verde, for example—under the eye of our always good-natured and beneficent Uncle Sam? [Applause.]

I can and will tell you one reason. Beside the millions spent in building the Roosevelt Dam—of which the civilized world is and always should be proud—it took more than \$500,000 to put a diversion dam in the river (where unexpected floods had washed out the dam built by the farmers) that would guarantee the delivery of the water, which dam, under private management, had not been properly built and could not be replaced with private capital. Private capital could not do it under the conditions then existing. After the construction of the Roosevelt Dam was begun, this immense diversion dam of the farmers went out. They could not meet the emergency. But our good old Uncle, always ready to be a friend to his people, could do it and did do it; and those good citizens who had the 100,000-acre water right, as they as-

sumed—which was only about half, and not to exceed two-thirds, of an effective water right so far as the productiveness of the land was concerned—have been benefited to the extent I have indicated by the government supplemental supply. The same good thing has happened on some of the projects in the judge's own good state. It is happening over on the North Platte, where they thought they had one of the greatest gravity river-water systems; it is happening now over in Idaho, and in nearly every section where the government has sufficient water in its reservoirs for such supplemental supply.

It strikes me, as I said in the beginning, that we have reached the stage when we must determine whether we shall further press the policy of the reclamation of arid and swamp lands by government activity, or "aid," whichever you prefer to term it, or whether we shall cease that method and turn it over to the interest-seeking greed of private enterprise, where the farmer will not only pay principal and interest, but a healthy bonus as well.

As I said before, we have 75,000,000 acres of swamp land and more than 25,000,000 acres of arid land yet to be reclaimed, the arid land being in the West and the swamp land in nearly all states; sufficient if gathered together in one body to make a great state in the Union, or enough to equal five Eastern states that might be named. And what does this mean? It means that we are peacefully conquering and propose further peacefully to conquer an immense territory—without turmoil or unfair force,

and without the loss of life. Why, my friends, with the money expended in three weeks of the European war we could, without the sacrifice of human life, conquer and convert from the deserts and swamps of our country into happy homes more territory than will ever be subjugated by any of the warring nations now engaged in Europe in the greatest and most useless conflict that history has dared record. [Applause.]

Then, is it not about time that our friends who have been opposing the government reclamation work, although doing so honestly—I question their judgment, not their motives—is it not about time that they join hands with us in urging the government to take steps peacefully to conquer all the deserts and swamps of our great country? [Applause.]

When we pause to think of the difference between present conditions under irrigation, and what they were 15 or 20 years ago, when we observe upon the glowing canvas of human experience a living picture of the many thousands of happy homes builded where only the jack rabbits, lizards, sage-brush, cacti, and mesquite thrived before; when we see cities rise Phoenix-like in the burning deserts; when we see this movement still advancing, disturbed in the even tenor of its way only by debates of this type, is it not time, yes, I ask, is it not time that we pause and consider what will be accomplished if we will only thoroughly get together and exert ourselves to the utmost toward the government reclamation of all these lands, whether arid or swamp, not alone in the West, but in the South and East—in Maine, Minne-

sota, Florida, Louisiana, as well as in New Mexico, Arizona, Montana, Oregon, and other good states of our great country? [Applause.]

In this I am reminded of what has been told of Patrick Henry—whether I am right in the personage or not is immaterial, for the illustration is equally as effective whether an office boy, an orator, or a statesman, but I think it was Patrick Henry—who, before our present great empire west of the Alleghenies was settled to any great extent, while out with a camping party upon a summit of the Alleghenies, was seen standing by himself, meditating, with the appearance of listening, when one of his friends said: "Pat, what are you listening to or thinking about?" to which he responded: "I am listening to the footsteps of the millions who will within the next half century inhabit the unsettled country west of these mountains."

Now is it not about time, my halting friends, that we "take the wings of morning—and the Barcan desert pierce," and that you join hands with us in the reclamation service? Have we not reached a time when we should stand together and "stop, look and listen" to the footsteps of the millions yet to inhabit the to-be-reclaimed arid and swamp lands of our nation? Is it not well that we peer into the future and see the many cities and patriotic homes to rise upon the now uninhabited lands, on the more than 100,000,000 acres lying idle and unused in our great country? I think it is, and I feel that you agree with me. Thanks for your patient attention. [Applause.]

SOLVING THE IRRIGATING PROBLEM WITH A DITCHING MACHINE

There have been various makeshift methods employed by farmers in the irrigation sections of this country to make and clean laterals and ditches—among the number being the shovel, the plow and the Fresno.

None of these were really effective for the purpose. For instance, in using the Fresno it is necessary to work crosswise of the laterals. This means that a strip anywhere from 10 to 18 feet must be left on each side on which to turn.

Nothing can be grown on this strip. Still, no better plan of running laterals was to be found until the advent of the V-shaped Ditching Machine, and when this made its appearance the problem of irrigating ditches was solved.

This machine does its own plowing. Cuts away sod and weeds and throws out its own cuttings as it goes.

It is equipped with a rolling coulter which prevents clogging in heavy Bermuda grass or alfalfa.

It opens the way for the cutting blade which follows.

In the past two years thousands of these machines have been put to work in the irrigated country and each is receiving the enthusiastic endorsement of the owners of these big ranches which are scattered all over Texas, Wyoming, Nebraska, New

Mexico, Utah, California and other sections of this country.

We suggest that those of our readers who are interested in the subject investigate the merits of the machines advertised in these pages and follow the lead of the men who are using them.

Considering its cost, a V-shaped Ditcher represents more value than any other machine on the farm, whether it be the big western ranch or the small farm "back East," whose owner is more concerned in solving the problem of carrying water off his land than in putting it on.

The V-shaped Ditcher meets the demands of both with an equal measure of efficiency.

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NEWS NOTES FROM IRRIGATION PROJECTS OF THE COUNTRY

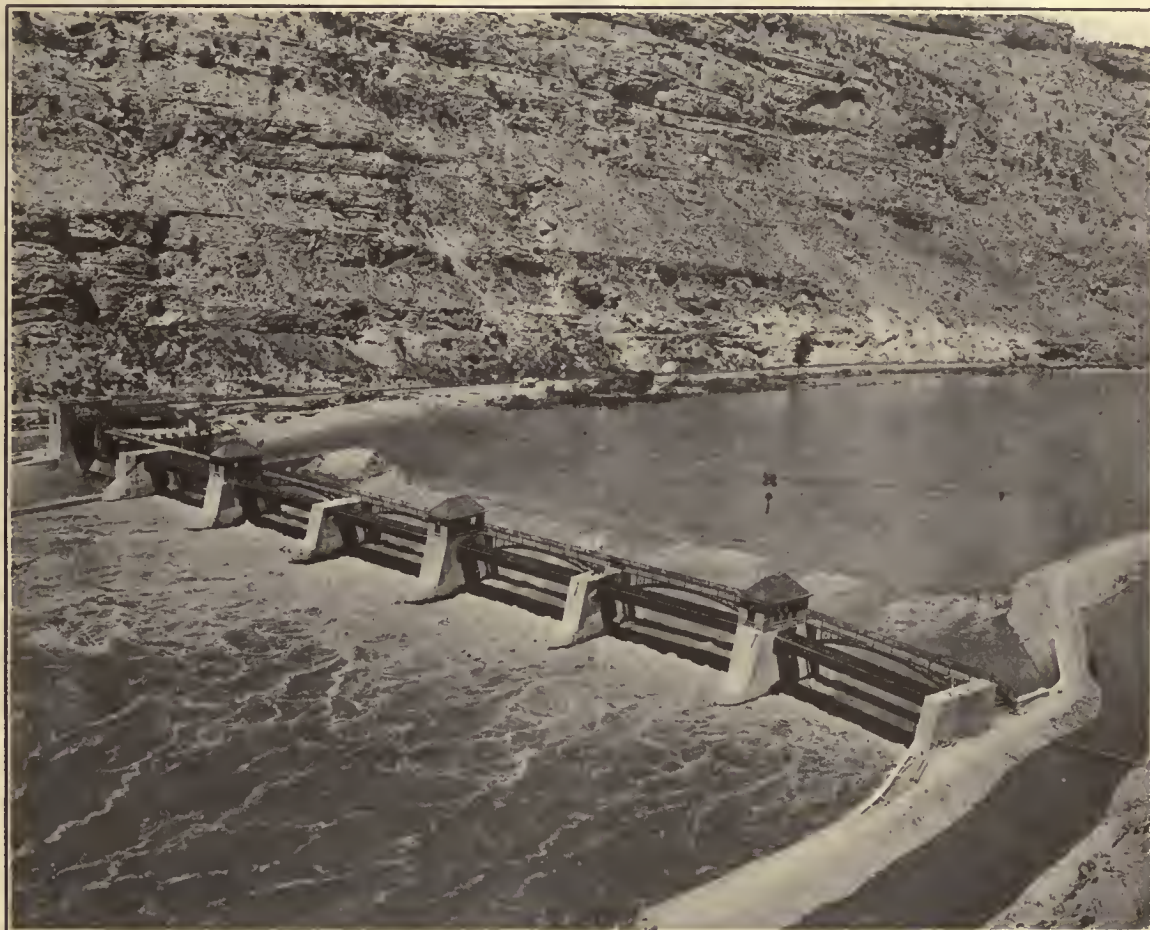
California

Having committed themselves to the plan of irrigation of a large area of land near Victorville, the officials and residents of San Bernardino county will have to carry this out, in all probability, according to recent statements made by State Engineer W. F. McClure. Engineer McClure further states that he originally opposed the project on the ground that it might involve too much litigation

basin, and pumped through these pipes to a reservoir and thence re-pumped to the high-line ditch from which it will be distributed by gravity. The estimated cost of the project is \$1,400,000. John Kennedy of Los Angeles is the contractor.

Without a dissenting vote the owners of the Jacinto section have agreed to organize an irrigation district em-

closed. The dam will be large enough to hold back 200,000 acre-feet of water. The water will flow into the reservoir from the Mokelumne river and from Dry creek. The present plans contemplate a supply of two acre feet of water, which is said to be sufficient for alfalfa, fruit and vegetable growing. The promoters claim that the water will be the cheapest irrigating water furnished in California, the reason being the proximity of



Roller Crest Diversion Dam, Grand Valley Project, Colorado. This dam is constructed on a comparatively new principle and is performing its work satisfactorily. This structure was erected under the supervision of Project Manager and Engineer J. H. Miner and will stand as a monument to the ability of this capable gentleman.

over certain water rights. The land owners in that section did not feel that way about it, however, and the work has now been sanctioned by the state engineer and will be rushed to completion. This project will embrace 20,000 acres.

Work has been resumed on the Lindsay-Strathmore irrigation project and same will be rushed to completion. There will be fifty miles of redwood pipes and 100 miles of laterals. The water will be obtained from 37 wells sunk in the Kaweah

basin, and pumped through these pipes to a reservoir and thence re-pumped to the high-line ditch from which it will be distributed by gravity. The estimated cost of the project is \$1,400,000. John Kennedy of Los Angeles is the contractor.

San Joaquin irrigationists are planning to construct a \$9,000,000 reservoir at Pine Flat, Fresno county, to irrigate and reclaim more than 1,000,000 acres in the San Joaquin valley. Approximately 75,000 acres have already been signed up and a district has been formed. It is planned to build a large dam, the exact site of which and its size have not been dis-

the irrigable land to the source of water supply, which obviates the construction of long and costly canals, ditches or flumes from the dam to the land to be watered.

M. D. Goodbody of San Diego has been awarded the contract for the construction of the proposed new intake in the main canal of the Imperial Irrigation District. The contract price of the work is \$150,000. By the terms of the contract the intake must be completed and turned over to the irrigation district not later than four months from the time of the

signing of the contract and the filing of the bond. The contract calls for 25 cents a cubic yard for earthwork and \$1.50 per cubic yard for rockwork in the construction of the intake, which will be of the "overpour" design, to prevent heavy silt passing from the Colorado river into the main canal. Ernest P. Shields will excavate the Tecolote canal, an important link in the water diversion system of the same project. The contract price for this work is named at \$82,000.

Land owners of Tranquility, Fresno county, have retained Attorney L. L. Dennett of Modesto as counsel in working out proceedings for the formation of an irrigation district, which they desire to form to take water from the north fork of Kings river to water approximately 14,000 acres.

Two of the sixteen wells comprising the first unit of the Terra Bella irrigation project have been tested out, No. 6 well showing 85 inches and No. 10 well 105 inches. Neither well is equipped for a capacity test, but arrangements are now being made to put on heavier equipment to test the wells to capacity. Construction work on the first unit is being rushed in all departments. Several miles of ditches have been dug. All pipes in the project are protected steel. Contractor W. A. Kraner states that he will have the work completed by July 1st. At the recent election of the district the following directors were re-elected: Chas. Hilton, T. M. Gronen and R. C. Gunnison; also treasurer, F. C. Rickey, and assessor-collector, E. R. Clemens.

After laying dormant for twenty-five years the Happy Valley Irrigation District has been reorganized, and at a recent meeting held in Olinda the following directors were named: J. L. Dwinell and S. C. Dick of Olinda; W. A. Palmer, Alfred J. Cutter and Thomas Miller of Cloverdale. The district was originally organized in 1891 to purchase the Hardscrabble Land and Irrigation System, but after all details had been arranged the company doubled the price and the proposition was dropped. Reorganization has been effected to purchase the same system from the Happy Land & Water Company, of which the Ehmann Olive Company is the principal owner. It is planned to bond the district for \$200,000 to purchase the present irrigation system, which will put a large acreage under water.

Colorado

F. B. Logan, E. C. Brooks and M. D. Brown, well known men of Nucla, representing some thirty prominent farmers of the west end of Montrose county, have filed with the county clerk and secretary of state, articles of incorporation of the Colorado Cooperative Extension & Enlargement Company. The plans of the new concern, as outlined in the articles, are to enlarge the present Colorado Colony ditch to more than double its present capacity at an estimated cost

of \$80,000, enlarging the present canal from a carrying capacity of 70 feet to 150 feet. The ditch will be built on the cooperative plan, any farmer desiring may work to help pay for his interest and water, and it is proposed that all work, material etc., will be paid for as the work progresses and no indebtedness will be created against the concern. The plan proposes the abandonment of the big flume across the Cottonwood gulch, which was a very expensive piece of work in the original Colony ditch, and building the canal around it. The water will be taken from the San Miguel river and carried for many miles along the rim of the canyon until it mounts out upon the mesa. When the enlargement project is completed it is expected that about 10,000 acres of new land will be brought under cultivation.

Idaho

A gigantic irrigation project has been launched at Soda Springs and steps have been taken to organize an irrigation district known as the Soda Springs-Blackfoot District. This district will utilize the waters of Blackfoot river and Soda creek, and will irrigate the rich farm lands lying north and east of Soda Springs and as far west as Davisville and Elexander, Ida.

The big cut just north of Montour being made for the canal of the Emmett Irrigation District at a cost of approximately \$55,000 has been completed. The cut is 1,800 feet long, 27 feet wide at the bottom, and 77 feet deep at the deepest place. The purpose of this cut is to eliminate tunnel No. 1, which is 1,500 feet long and is double barreled. Each barrel is 4½x6 feet in size. The tunnel is too small and does not carry enough water for the irrigation district. The Emmett irrigation district embraces about 22,000 acres.

Montana

Under authority of the Secretary of the Interior contract has been awarded to the Vulcan Iron Works of Denver, Colo., for furnishing butterfly and cylinder gates for use in connection with the McDonald and Tabor reservoirs on the Flathead irrigation project in Montana. The contract price for the gates delivered f. o. b. Denver is \$15,996.

The Keystone Irrigation District held a special election at Sprague recently and voted unanimously to issue \$200,000 worth of bonds for the construction of the Keystone Irrigation project. The project covers several thousand acres west of Sprague and the water is to be taken from Sprague lake.

It is announced that the government is about to purchase the artesian wells from the farmers in the vicinity of Camas, the water to be used in the reclamation of the Little Bitter Root Valley. The original owners of the wells will be left sufficient water for

domestic purposes, the remainder to be diverted for irrigation.

Oregon

Secretary Lane, after further conference with the reclamation service, has announced that inasmuch as the Malheur irrigation project is to be financed by a bond issue, and as the reclamation fund is low, he will not recommend any appropriation this season for starting work on same. This decision means that Oregon will get no appropriations for reclamation this session, save for the Umatilla and Klamath projects.

The Riverside Irrigation & Power Company of Malheur county has filed certificate of dissolution.

The government will throw open for homestead entry in the near future, 4,900 acres of level, fertile, irrigated land in the reclaimed bed of Tule lake. A drawing for entries will take place in the spring. This lake is a shallow body of water laying partly in Klamath county and partly in Modoc and Siskiyou counties in California, which is being reclaimed by diverting Lost river, its source of supply, into the Klamath river. More than 30,000 acres are yet to be drained and opened to entry. It is stated that the land will be thrown open in tracts of eighty acres.

Texas

Articles of incorporation have been filed by the Canadian Valley Irrigation Company, headquarters in Amarillo, Tex., with a capital stock of \$25,000, all paid in, about \$2,200 in cash and the remainder in large part represented by a water right for 6,250 acre-feet per annum from the natural flow and flood waters of the Canadian river to irrigate 2,500 acres of land in Potter county, together with ditches, laterals and equipment. Incorporators: F. O. Works, G. S. Murphy, L. A. Ramsey and H. Rietman of Amarillo.

Washington

The development of 500,000 horsepower at Priest Rapids, nine miles from Beverly, is planned by the Washington Irrigation & Development Company, according to G. L. Parker, district engineer in charge of the United States Geological Survey, headquarters for Washington, in the city of Tacoma.

Ernest Riste, secretary of the board of directors of the West Okanogan Valley Irrigation District, has received from Washington, D. C., a draft on the United States Treasury for \$95,000 in payment for the pro rata cost of construction of the system applied to the numerous Indian allotments in the valley under the ditch. These Indian allotments within the territory covered by this irrigation project, include many acres that can be watered, and the installation of the system enhances the value of that land.

Miscellaneous

The Daniel Hayes Company of Idaho, a land selling corporation, have opened a branch office in Dixon, Ill., and will make that city its headquarters for the handling of its business in Northern Illinois. A number of Dixon people are financially interested in the concern which has been doing business in Rock Island, Ill., for over forty years. At present the company has a big project in Idaho, where they are going to put 40,000 acres of land under irrigation.

Excavations have been commenced on the diversion dam several miles below Cimarron to place the waters under the Eagle's nest project on the adjoining lands. The entire project is being constructed as rapidly as possible, and it is generally believed that the project will be completed not later than next fall.

The Secretary of the Interior has authorized the Reclamation Service to execute contract with the El Paso Foundry & Machine Company, El Paso, Tex., for furnishing and delivering needle valves for the Roosevelt dam, Salt River irrigation project, Arizona. These valves will be delivered for \$39,570 .. o. b. cars at El Paso, Tex.

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If you want to keep in touch with all sides of the Reclamation Problem send \$1.00 for one year's subscription to the Irrigation Age, 30 North Dearborn Street, Chicago.

Preparations are being made by the Richardson Construction Company of Los Angeles, Cal., to resume on an extensive scale the work of constructing its big irrigation enterprise in the valley of the Yaqui river, in the southern part of the state of Sonora. This project involves the reclamation of about eight hundred thousand acres of land. The water supply will be obtained from the Yaqui river by means of a dam and storage reservoir.

The pamphlet "Irrigation Laws" is now off the press and ready for gratuitous distribution among those who may apply early and before the limited supply has been entirely exhausted. The compilation, as now prepared, taken in the code enacted by the 1915 legislature with all amendments to existing laws and the cross references carried by it makes it the most comprehensive publication on this subject that has yet been issued.

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FREE—A copy of "Boyd's Farmers' Alfalfa Guide," price 10c, will be mailed free to any reader of Irrigation Age who will write for the book and mention Irrigation Age.

W. W. Wilson, A. J. Butler, D. E. Greenwood, and August M. Nelson, of Sandy, Utah, have filed application with the state engineer of Utah for the use of one cubic foot of water from Utah lake and Jordan river for irrigation, culinary and domestic purposes at Midvale.

Work of construction has begun on the main distribution laterals of the Lake Charlotte project in the southern part of Colfax county, New Mexico. The Colmor Irrigated Land Company has started the work through Palmer & Harris, contractors of Denver, Colo., who are on the ground now with a large outfit and will push the work as rapidly as the condition of the weather during the remainder of the winter will permit.

The Lawton, Okla., irrigation district was created at an election held in Lawton late in February. A tract of land embracing 2,500 acres, lying to the south of Lawton, will be irrigated. Congress has already appropriated \$100,000 for this project. The reservoir at Lake Lawtonka, the source of water supply for the city of Lawton, is to be used by the government while experimenting upon the area mentioned. When a larger area is added, this dam will be raised an additional fifty feet and thus many millions of gallons of water will be added, as this structure spans a deep valley in the Wichita mountains.

The Dry Gulch Irrigation Company of Roosevelt, Utah, has filed an application with the state engineer for 2,760 acre-feet of water from Montus creek, Duchesne county, to assist in irrigating 5,680 acres of land.

The New York Reservoir Land & Irrigation Company has filed articles of incorporation. Capital stock, \$10,000; headquarters, Cora, Wyo. (Fremont county). Directors: P. W. Jenkins, A. W. Mushon, E. M. Belknap, Guy Holt and C. C. Alexander.

IRRIGATION BY MEANS OF CANVAS TUBE.

A very interesting contrivance was demonstrated last summer at the College farm. It consists of a long canvas tube in which are placed small brass gates, so placed that each gate will come opposite a row down which it is desired to discharge irrigation water. The tube is laid along the high part of the field, connected with the ditch at the upper end, the water runs through this tube without; the water is discharged through the gate openings in the amount desired by the irrigator, and the supply for each tube is controlled by opening the small gates in the tubes. The canvas tube decreases in size as it extends from the ditch so that the smaller head of water flowing at the extreme lower end is carried through a much smaller tube, and thereby a saving of material is obtained.

So far as the control of irrigation water is concerned this device is

ideal. Further than that it is easily changed from place to place by allowing the water to run out of it and then dragging it along the ground. The only thing that will have to be watched is that it is thoroughly cleaned when irrigation ceases, because the canvas will of course in time rot, and the same care must be given a tube of this kind as is given

to the ordinary canvass dam in order to preserve the same.

E. B. HOUSE,
Colorado Agricultural College,
Fort Collins, Colo.

If you want to keep in touch with all sides of the Reclamation Problem send \$1.00 for one year's subscription to the Irrigation Age, 30 North Dearborn Street, Chicago.



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Thirty-Second Year

THE IRRIGATION AGE

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With which is Merged

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MODERN IRRIGATION

THE IRRIGATION ERA

ARIO AMERICA

THE WATER USERS' BULLETIN

THE DRAINAGE JOURNAL

MID-WEST

THE FARM HERALD

THE IRRIGATOR

D. H. ANDERSON

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D. H. ANDERSON, Editor

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Official organ Federation of Tree Growing Clubs of America. D. H. Anderson, Secretary.

The Executive Committee of the National Federation of Water Users' Association has taken action whereby THE IRRIGATION AGE is created the official organ of this vast organization, representing 1,000,000 persons on the government irrigation projects.

Federal Farm Loan Act Helps District Plan

In the early operation of the Reclamation Act and an attempted adjustment of that law to assist settlers, a strong sentiment was found against the organization of Water Users' Associations whereby the title of each holding was transferred to the Government as security for the cost or estimated cost of bringing a project to a point where water was ready for delivery to the land. This sentiment was founded on the fact that local money interests took the position that the security given the Government was in fact, a first mortgage on the land and settlers, who had secured land and water rights under this act and who at the end of the first or second year were confronted with the need of additional money for farm equipment and other purposes, found that the individuals who controlled the local money market were not inclined to make what they termed second mortgage loans.

This attitude worked hardships on many hard working and ambitious settlers and in numerous instances resulted in failure, where a reasonable credit extended at a critical time would have kept them on the road to success.

An effort was made to remedy this condition but no concerted movement resulted until changes in the personnel of the staff of the Reclamation service brought out men who had been in close touch with the settlers, and understood the hopelessness of their position.

The first suggestions for betterment of conditions were embodied in the plan suggested by Judge King of changing the present Water Users' Associations into Irrigation District organizations under a plan similar to the California District Law or that now in force in Oregon, Idaho, and other western states.

The principal objection offered was that in forming a district the bonds issued would, in order to protect the Government, cover not only the estimated cost but also all additional expenditures resulting from errors on the part of the engineers who made the original estimates.

The attitude of a number of Water Users' Associations leads us to the conclusion that there must be an equitable plan suggested before many of the associations will consent to a change.

Several of the irrigation district laws of the western states provide for co-operation with the United States Reclamation Service and if the difference between estimated and actual cost is amicably settled there are many reasons why the district plan is best for the settler, among them being the possible availability of the Federal Farm Loan Act.

By the terms of this act no loan can be made on land on which there is a prior mortgage but it has been held that the lien for bonds of an irrigation district is not to be considered a mortgage, it being similar to municipal bonds which do not prevent a property holder from making a loan on his holding.

It is stated that in making a loan under the Federal Farm Loan Act the board considers the bonded indebtedness in determining how much of a loan the land is good for but it is not prohibited from making the loan because of such bond lien. It is therefore clear that the district plan operates in favor of the individual borrower whose needs for financial aid at a critical time may thus be provided for.

Summary In a recent communication from
Reclamation the United States Reclamation Service headquarters is enclosed a brief
Service advance statement of the summary
Results of construction results to December 31, 1916. The salient features of this summary are:

The Service furnished water for irrigating about 1,000,000 acres of land.

Has available reservoir capacity of 9,000,000 acre-feet.

Has dug nearly 11,000 miles of canals and drains.

Has built 100 storage and diversion dams, as follows:

	No.	Volume
Masonry.....	42	2,000,000 cu. yds.
Earth	39	10,000,000 cu. yds.
Rockfill and crib.....	19	1,000,000 cu. yds.
Total	100	13,000,000 cu. yds.

Has built over 77,000 canal structures.

Has built about 5,600 bridges.

Has built over 6,600 culverts.

Has built 385 miles of pipe lines.

Has built 95 miles of flumes.

Has built 2,800 miles of telephone lines.

Has built 438 miles of power transmission lines, and excavated nearly 150,000,000 cubic yards of material.

This is a fine showing and reflects credit on the Department of the Interior and officials of the Reclamation Service. It is gratifying to note that many important changes have been made in the Reclamation Service through the efforts of Secretary Lane and Director Davis.

A Friendly In commenting on an editorial in a
Word recent issue of the IRRIGATION AGE
From in the Casa Grande Valley Dispatch
Arizona Arizona, the editor offers the following suggestion:

"The Dispatch would suggest to all landowners who are not subscribers, that they will find it greatly to their advantage to take the IRRIGATION AGE and read it regularly. It is devoted almost exclusively to irrigation and irrigation de-

velopment, and contains much which would be of great value to irrigators and prospective irrigators.

The editor of IRRIGATION AGE heartily appreciates this cordial expression and agrees that there are thousands of farmers under irrigation who would be greatly benefited by a perusal of each issue of this journal.

Recent information from Fresno, California, where Mr. George Albert Smith, president of the International Irrigation Congress has been in consultation with L. W. Nares, chairman of the board of governors of that body, leads us to believe that the 1917 session may not materialize owing, it is stated, by the San Francisco Chronicle, to war conditions. Plans for the congress were discussed by these gentlemen, but because of the unsettled condition no definite date nor place was decided upon.

These statements may furnish an explanation satisfactory to the average reader; they will, however, be reluctantly accepted by those who are familiar with the history of this organization.

The conclusions in the case are that the congress degenerated to a poverty-stricken position, owing to the fact that it is a one-man institution, dominated by its secretary alone, who, however pleasing his personality, has laid himself open to criticism by his lack of managerial ability. Furthermore, he is perhaps thinking more deeply on the question of his salary rather than the welfare and future possibilities of the organization.

We presented in the November number of the IRRIGATION AGE an editorial headed, "What Ails the Irrigation Congress," from which we quote the following paragraphs giving as clearly as possible the editor's views on this subject:

"To what is the decline of this potential agency of helpfulness to the entire West attributable? Why has the expensive machinery of the Congress, instead of at least maintaining its former prestige, failed to vindicate itself? Were the debacle at El Paso—for such it was, in point of attendance—an isolated phenomenon, the situation could be dismissed without serious misgivings. The fact that the Congresses of 1915 and 1914 were also meagerly attended—not to speak of the failure to convene at all in 1913—points, however, to a deep-seated and fundamental defect.

"The doctrine has been accepted throughout the entire civilized world that those who are charged with the immediate responsibility of success or failure of institutions, whether commercial, political or semi-public, shall be given a reasonable period in which to demonstrate their efficiency, and that those who are found wanting in the balance shall be retired. This is a wise provision, which is recognized at the annual meetings of corporate bodies, where officers must stand or fall upon the record of their

achievements. In the cabinets of all enlightened governments, those whose conduct fails to justify their titles or emoluments are permitted to retire—with more or less aplomb. There can be nothing personal in the statement that five years of uninterrupted power should prove an adequate period in which to test the measure of a man's ability. The activities, the aims and ideals, everything that can be assumed to represent the constructive policies and the excuse for existence of the Congress, are centered in its permanent executive officer—its secretary. He is not one who is asked or required to do what his forerunners of conspicuous achievement volunteered—to donate his time and energies, or even his financial support. The secretary of the Congress is not only the recipient of a liberal salary, but the beneficiary of various emoluments and privileges. He is almost unhampered in the conduct of affairs. He exercises—or would do so were he the strong character required for such an office—a free hand for the execution of anything within reason. The incumbency of such an honorable office is almost dazzling in its prospects of usefulness to the West—to the nation at large—the right man in this place could easily become a figure of national importance.

"The AGE, in the past, has never permitted personal considerations to outweigh public considerations, and it conceives the present crisis in the affairs of the Congress to be of such a nature that anything less than a frank statement and review of the situation would constitute a dereliction of duty towards its readers and the public interest. The office of permanent secretary, with liberal appropriations, was created in 1909, and it has been clothed continuously since that time by one man—the present incumbent—who, however agreeable, personally, must be held responsible for the present condition of the Congress.

"The inevitable conclusion of all the facts is that he, and his administration, have been weighed in the balance and found lamentably wanting. Shall his costly regime be continued indefinitely?"

There is no doubt that Ogden or Salt Lake City would have entertained the congress in 1917, had it not been for the unreasonable guarantee asked by the Secretary and Board of Governors.

The International Irrigation Congress will never reach its former position of usefulness until the city in which it is to be held is permitted to decide on the question of expense in entertaining that body as well as the amount of money necessary to pay the salary of its permanent officer, the secretary.

Alfalfa a Good Crop in Kansas

A prominent ranchman and irrigation commissioner for the state of Kansas, Mr. J. W. Lough, of Scott City, has demonstrated that alfalfa is a big and profitable crop for Kansas farmers. He has arranged for the construction of twelve sets of improvements this spring for tenants on his large ranch near Scott

City. His \$50,000 electric pump irrigation plant is ready for service, and as he wants his land sown to alfalfa as rapidly as possible, he is leasing a part of it on very reasonable terms to parties who are willing to assist in converting the raw prairie into productive alfalfa fields that will prove remunerative to tenant and owner alike. Lough furnishes the land, the seed, and the water for one-half the crop, an arrangement that will prove profitable to both parties.

The capacity of the pumping plant is 28,000 gallons per minute, a quantity of water ample to irrigate every foot of 5,000 acres once every two weeks. This is double the amount of water ever before required in the production of full crops. On the land already under irrigation, Lough raised more than eight tons of choice alfalfa hay per acre last season, for which he refused \$20 per ton. The soil and the climate are ideal for the production of the very best grade of alfalfa, and with an abundance of water assured, the proposition has appealed to a class of farmers who are sure to make a success of the undertaking. They will share equally with Lough in raising this alfalfa.

This appears to be a fair plan for both Mr. Lough and his tenants, and if alfalfa hay remains anywhere near its present price the tenants should in a few years be working and marketing crops from their own land.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of The Irrigation Age, published monthly at Chicago, Ill., for April, 1917.
State of Illinois, County of Cook, ss.

Before me, a notary public, in and for the State and county aforesaid, personally appeared D. H. Anderson, who, having been duly sworn according to law, depose and says that he is the publisher of The Irrigation Age and that the following is to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:
Publisher—D. H. Anderson, 30 No. Dearborn St.
Editor—D. H. Anderson, 30 No. Dearborn St.
Managing Editor—D. H. Anderson, 30 No. Dearborn St.
Business Manager—E. Donnelly, 30 No. Dearborn St.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.)
D. A. Anderson, 30 No. Dearborn St.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)
None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.
D. H. ANDERSON,
Editor, Publisher.

Sworn to and subscribed before me this 4th day of April, 1917.

(SEAL)

MICHAEL J. O'MALLEY,
(My commission expires March 8, 1920.)

RULING CONCERNING SOLDIERS HOMESTEAD RIGHTS

A very important administrative ruling, construing the law relating to soldiers' additional homestead rights, was made by Secretary of the Interior Lane on February 15, 1917.

Prior to 1872, while a qualified person had the right to enter 160 acres on a homestead, an entry of less than that acreage exhausted his right. Out of gratitude to the soldier of the civil war Congress passed an act authorizing a soldier whose service had amounted to 90 days and who had been honorably discharged, etc., to make an additional entry of land such as when added to the quantity already entered by him (prior to June 22, 1874, when the Revised Statutes went into effect) would not exceed 160 acres. In other words, if he had already entered 80 acres, he had an additional right to enter another 80 acres. Until 1896, the Land Department construed this as meaning a wholly personal and *unassignable* right.

Another section of the Revised Statutes provided that in case of the death of the soldier, "his widow, if unmarried, or in case of her death or marriage, then his minor orphan children, by a guardian duly appointed and officially accredited at the Department of the Interior," should be entitled to the benefits included in the chapter, which has been construed as including the soldier's additional right.

In 1896, the Supreme Court held that the beneficiary of this additional right need not personally enter the land, but might assign the right to another, if he did not elect to acquire more land, thus indirectly getting the personal benefit intended by Congress.

After this decision, much confusion arose, and exceeding the requirements of the decision, the Department admitted assignments not made by the soldier, the widow, or the guardian of the minor children, but by heirs of any of them, or by administrators.

The result was to create out of these wholly personal rights a sort of "scrip" which has been bought for a song and sold by speculators at immense profits. In its evolution, it has produced all sorts of unconscionable claims and has cost the

Government thousands of acres of land, benefiting only persons whom Congress had never mentioned in this legislation. Dealers in these rights, when unable to find any heirs of a soldier, have even secured letters of administration on the estate of a soldier on the theory that the additional right was an asset of his estate by escheating, in the absence of heirs, to the state in which the soldier was domiciled at the time of his death. An 80 acre right would be purchased by the speculator, in this

manner, for a trivial sum, and would be sold by him for \$800 or more. The appropriation of the public domain by such means has acquired the proportions of a scandal.

This, by his ruling of February 15, 1917, Secretary Lane has stopped. He rules that Congress merely intended to benefit the parties described in the law—the soldier, his dependent widow, or his dependent children—that is, his minor orphan

children; that it was never intended that the right should descend to heirs generally, near or remote; much less by escheat to a state. He rules that unless the right be exercised by personal use or assignment in the lifetime of the soldier, it passes to the widow similarly to be used during her widowhood, or if she dies or remarries, then to the minor children to be appropriated by their guardian during their minority. If not so used by any of these, then the right ceases and determines and never becomes the asset of anyone's state.

The commissioner of the general land office is directed that "no soldiers' additional right assigned by the heirs generally or by the administrator of the estate of a deceased soldier, or his widow, or of his minor orphan children, or directly by such 'minor children' after they shall have reached majority, thus assigned after the date hereof, will be recognized as the valid basis of entry of public lands."

But the secretary says that he is mindful that many persons may have heretofore acquired such additional rights in good faith, on the strength of a practice that is not in harmony with his new ruling, and for that reason he directs that his ruling shall not be given any retroactive effect where the additional right was actually sold and the transaction was wholly completed and formally consummated by actual delivery of the written assignment prior to February 15, 1917.



CONCRETE IN IRRIGATION CANAL CONSTRUCTION

One of the Earliest Uses of Concrete Lining for Irrigation Canals. This View Shows What Is Known as the Upper Canal of the Riverside Water Company, California.

WHAT EFFECT DOES AN IRRIGATION DISTRICT HAVE ON LANDOWNERS?

Address to the irrigation men of the northwest at Boise, Idaho, January 17, 1917, by W. O. Cotton of Idaho Falls, Idaho.

At the present time there is a great deal said about irrigation districts of the west, in fact enough has been said before the National Congress in regard to the irrigation district law being the best possible means of reclaiming the remaining thirty or forty million acres of arid land of the west (for which there is available water), that the Federal Government is now preparing a report on the irrigation districts of the west.

Not long ago a strong banking establishment of the northwest was desirous of investing in good securities which carried a high rate of interest; thereupon their attorney was called upon to render a report upon irrigation districts of the western states; this report conveyed the opinion that a great many districts had failed in California, a certain number in Washington and a high per cent had failed in Oregon, and that the record in Idaho was fully as bad. The truth of the matter is that there is only one failure in Idaho, or two at most, out of some twenty districts. Idaho has a right to be proud of her record in this regard.

The effect of an organized irrigation district on the land owners might be expressed as follows:

1. Enables communities to purchase and operate their own irrigation systems.
2. Enables land owners in irrigation projects to finance improvements with the elimination of profit and overhead cost.
3. Places control of entire project in hands of the land owners.
4. Stimulates development of raw land.
5. Tends towards breaking up large holdings and substitution of intensive for extensive agriculture.
6. In some states works exempt from taxation.
7. Public lands bear their share of the cost.
8. State lands may pay their share of the cost.
9. May co-operate with U. S. Reclamation Service.

10. Enables land owners to take advantage of Federal Farm Loan Act.

1. Enables Communities to Purchase and Operate Their Own Irrigation Systems

Prior to the advent of the irrigation district law, canal companies were formed for the purpose of constructing irrigation works, which usually consisted of a crude diversion dam in the supply stream and a crude canal simply to assist nature to water a few acres or possibly a few farms in the valley adjacent to the stream. In a short time the necessity arose for a canal on higher ground to cover more farms in the valley, hence another company is formed. This procedure has gone on in some cases until there are several canals, one above the other, all watering parallel lands in the same valley which would today be watered by one large canal system financed through an organized district.

It is comparatively easy for a colony of people whose lands are adjacent and susceptible of one mode of irrigation to band themselves together and

organize an irrigation district in which event bonds can be issued and sold or exchanged for construction work on an irrigation system; this enables the settler to plow, level, fence and subdue his farm and begin deriving an income before the first bonds mature, which is in the eleventh year. Or for instance an irrigation system has been built and operated by private company, that the management is poor, and that the water rents are high in order to take care of interest on invested capital and the irrigators have no redress; then if an irrigation district is formed, bonds can be issued and given in exchange for the system; the system is then operated by the landowners, and if the management is still poor and the cost high it is their own fault.

Even where a mutual company is in existence and there is no outstanding indebtedness it is often found desirable to adopt the district form for the purpose of facilitating the collection of assessments. There are four small districts in northern Idaho pumping water out of Haden Lake. Their systems were built by companies with the understanding that they would be turned over to the landowners when a certain percentage should be paid for. Two of these have been in operation several years as districts, and the other two are in process of taking over the plants.

In Nebraska along the North Platte river, there are districts formed from mutual water companies without any indebtedness, the mutual turning over the system to the district as an entity. Assessments have been collected much more readily under the district organization for the landowners naturally object to being sold out.

I have in mind several stock companies where the settlers have learned that a fifty per cent water right at the upper end is equal to a hundred per cent right at the lower end, and at the present time the man at the lower end pays assessments on a great deal more stock than the man at the upper end and gets less water. Under an organized district every acre pays according to its benefits, and the district is obliged to give an equal distribution of water to land within the district.

2. Enables Landowners in Irrigation Projects to Finance Improvements with the Elimination of Profit

Where an irrigation project is under way and there is no money available for much needed improvements which when made will lower the operation cost, the irrigation district provides a method of financing these improvements through its ability to issue bonds and its sovereign power of taxation, and bond buyers who are disposed to invest in irrigation securities favor the district on account of its taxing power. Savings banks and conservative bond houses on the coast will buy bonds for improvements when they will not buy the bonds of an undeveloped district. In this way bonds of the Hood River and East Fork districts in Oregon; Cascade, Union Gap, and Wenatchee districts in Washington; Yellowstone district in Montana, and Poplar district

in Idaho, have in the past few years been purchased by very conservative banking concerns in Portland, Seattle and Spokane. These communities stand proven and their bonds secured by a lien on the land find a good market.

These improvements are worked out by the engineer of the district and made at cost without the profit of a promotion company, nor the heavy overhead cost of some organizations.

3. Places Control of Entire Project in Hands of the Landowners

Under district law a director must not only be a landowner, but must be a resident of the district; by this means the most progressive and influential men are usually selected as directors. These directors then select the secretary-treasurer and manager from persons who have notable qualifications in their respective directions, all of whom are responsible to the directors. One director is elected each year to serve for a term of three years. The collection of assessments in the districts is practically the same as the collection of state and county taxes. The above are the three additional arguments in favor of the district plan.

4. Stimulates Development of Raw Land

Owing to the fact that all land under the system is subject to the bonded indebtedness and must pay interest charges whether cultivated or uncultivated, it behooves the owner of raw land to put such land on a paying basis in order to meet these annual charges and thus there is more of a check upon speculation and more of an incentive to bona fide development than under a private corporation where no land can be assessed unless the owner chooses to obligate himself. Cases can, of course, be cited where land is held for speculation, but the point is, that an irrigation district offers a less fruitful field under the same conditions.

The holding of all irrigable land for maintenance and operation expense also tends toward this end. The Idaho law permits these costs to be defrayed by (1) levies on all land (2) tolls or charges for water actually used (3) a combination of both. To promote the development of raw land, uniform levies would be desirable, but to promote economy in the use of water, charges according to the quantity used would seem productive of the best results; hence where both ends are to be attained the most practicable system appears to be a combination of the two methods and this is in some places used, fixed expenses like maintenance of the main canal, betterment work and repairing the breaks, being defrayed by annual levies on all the land; and operating expenses, salaries of water delivery force, etc., being paid from tolls for water actually used. The theory of this division is, that the former expense must go on whether any water is delivered or not to the vacant lands, and consequently all should share the burden, but the expenses that are not fixed and are incidental to the delivery of water, should be charged to the users only.

Sometimes, of course, development is not stimulated to the extent expected; for example in East Fork and Hood River irrigation districts of Oregon, where all land is assessed alike, it is stated that the owners of undeveloped land are paying assessments and are not disposed to bring their lands under cultivation any faster on that account, but

this I think would be found to be an exceptional case and manifestly is not good business practice. The only raw land in districts of eastern Idaho are lands which belong to some estate which is in litigation.

5. Tends Towards Breaking Up Large Holdings and Substitutes Intensive for Extensive Agriculture

This point would probably be more sharply drawn in California than in Idaho for this reason: I will deal with California development rather than Idaho. California started out to be a state of large holdings when Spanish grants were made and to some extent the same thing holds true today. The condition that gave rise to the Wright Act in California was the desire of the Modesto section to obtain a water supply for irrigation in spite of the opposition of large land owners, and in this respect Modesto was only representative of a number of communities. It was the desire for real development that started the irrigation districts idea in all the arid and semi-arid states that now have the district law upon their statutes. The history of nearly all of these states is similar to the history of Idaho in that the first district laws were not thoroughly workable and constitutional; however, Idaho district law is now probably the best of any of the states.

Where, therefore, in a given section the sentiment of the community is in favor of irrigation development, the district form of organization provides a feasible method of forcing an obstructing minority to submit, and where this minority holds large tracts of land which are needed for inclusion in the district in order to cut down the acreage cost to a reasonable figure the tendency is toward breaking up of these holdings, for an acreage cost applied to five hundred or a thousand acres reaches a figure which can hardly be taken care of on a dry farming basis. The result is that these holdings are divided, and so intensive farming under irrigation takes the place of dry farming on a big scale. This was exactly the situation in California.

From the beginning of the nineteenth century grain farming on a vast scale was the rule in the Sacramento Valley and in the San Joaquin Valley as far north as the rainfall would permit. These holdings reached 25,000 acres in many cases, and often much more. As time went on and the fertility of the soil was reduced by constant cropping, the profits naturally decreased until finally a large farm could hardly be operated at any profit. Nevertheless those big land owners were absolutely opposed to any change, and it was these men who furnished the backbone of the opposition to the irrigation district law in California during the many years preceding its final acceptance as a workable law. In some states the mistake was sometimes made of trying to force a district where the community was really opposed to it. It was possible to do this, for the original law permitted fifty or a majority of the land owners to propose a district and permitted organization if two-thirds of the votes cast were in favor. That is, a bare majority of land owners who might own one acre each, could propose the district and two-thirds could carry it. This percentage might consist of an irresponsible section of the populace, where the real interests involved were opposed and such irresponsible persons could vote

big bond issues on a vast territory in which they themselves had little financial interest. This was about what happened in the Central irrigation district near Willows and the continued opposition of large landowners finally killed the district after many miles of canal had been built. The law has since been changed to require a majority of the acreage as well, which is the same as the Idaho law; hence the point to be made is that where the sentiment of the community favors development by irrigation, obstructing land owners can be forced into line and their holdings forced into an agriculture more beneficial to the public good, as was the case with Modesto and Turlock districts, but where the real sentiment of the community is opposed to such development, it has in certain cases proven to be a mistake for the minority to go over the heads of the majority interests.

6. In Some States, Works Exempt from Taxation

Some states provide that rights of way, ditches, reservoirs, etc., and other property of like character belonging to any irrigation district shall not be taxed for state, county or municipal purposes. In Idaho such a law is not necessary as Sub. 12 of Section 1644, Idaho Revised Codes, exempts all public corporate bodies, which, of course, includes irrigation districts as water is used by the owners; if water were sold or rented, the property could then be assessed.

7. Public Lands Bear Their Share of Cost

Under the terms of the Smith bill passed by Congress at its last session, provision is made for the inclusion of public lands and their sharing of the expense of the project after the district has been approved as a feasible proposition by the secretary of the interior. The Government cannot be held for assessments, but it is provided that entered or unentered government land may be included and entered land sold for taxes, and before patent is issued proof must be made of the payment of all the district assessments in full to date.

One factor which in the past has been the cause of the failure of many irrigation districts, has been the large acreage of public land within the district which bore no part of the expense of the project. This situation will be alleviated where any public land is entered in the future in any districts which are meritorious enough to secure the approval of the Interior Department. The owner of private land will thus have his burden eased to that extent, and the entryman upon public land will be required to contribute to the cost of the system, which has enhanced the value of his land, whether he uses district water or not; in other words the fact of his securing land from the Government instead of from private individuals, will give him no advantage in his relation to the irrigation district.

8. State Lands May Pay Their Share

The Idaho Law (Sec. 2439) provides that the State Board of Land Commissioners may contract with the irrigation district to pay to such districts the full benefit accruing to state lands within the district, as determined by the state engineer and the state board.

This means that the state lands, whether entered or unentered, may contribute their proportionate cost of a meritorious project, provided such

projects be an irrigation district, with the result that private land owners are not required to carry all the burden themselves.

9. Cooperation with United States Reclamation Service

Most of the irrigation district laws of the several western states provide for co-operation with the United States reclamation service.

The gist of these provisions is that a district may contract with the reclamation service for the latter to build the irrigation system for the district at the Government's expense, the district depositing bonds with the government as a pledge for repayment of the cost without interest or merely considering the contract as a lien for repayment without any bond issue. The argument in favor of this, is that whatever may have been the mistakes of the reclamation service in the past, it is now a corps of highly trained irrigation engineers with much experience in irrigation construction behind them, and irrigation districts are given legal authority to secure the service of this organization for the actual cost of construction to be repaid over a series of years. The service has accordingly constructed systems for several districts in the Yakima Valley, Washington. Another feature of co-operation with the reclamation service is the reorganization of water users' associations into irrigation districts.

There are many arguments in favor of such a change and most of them can be found in an article by Mr. E. H. Burr and Judge King in the Reclamation Record; Mr. Burr having been assigned to the special task of arranging for such reorganization and having consequently given the subject considerable study. The Sunnyside Water Users' Association in Yakima Valley, Washington, has gone on record as approving such a change.

10. Enables Landowners to Take Advantage of the Federal Farm Loan Act

By the terms of the Federal Farm Loan Act, no loan can be made on land on which there is a prior mortgage. It has been held, however, that the lien for bonds of an irrigation district is not to be considered a mortgage in this case. Of course, in making the loan the board will consider the bonded indebtedness in determining how much of a loan the land is good for, but it is not prohibited from making the loan because of such bond lien. This is an advantage which a private company with its construction cost secured by individual mortgages cannot claim, and operates distinctly in favor of the landowners in an irrigation district.

I might say here that there is a movement on foot now to secure legislation which will very materially benefit the irrigation districts. We are desirous of a law which will enable bankers of the state to use irrigation district bonds as security for state, county, city and school district funds deposited in the banks. Under the present law (Sec. 2017, Vol. 1, Civil Code) such funds placed in banks by the treasurer of the state or municipality making the deposit must be secured by the bank, by the giving of a bond for the return of the money or by the deposit with the state or municipality of certain securities which are construed to include bonds and obligations of the United States, the District of Columbia, State of Idaho, counties of the state, cities, villages, town and school districts; warrants

of the state and warrants or interest bearing obligations of any county or city of the state and bonds of any association, corporation or company approved by the board of governors of the New York Exchange and listed on the New York Stock Exchange. You will note that irrigation districts are not mentioned in the foregoing list. It has always seemed to me unfair in the state to refuse legislation which would permit banks supervised by the state to use irrigation district securities as security on receipt of deposits of the state or municipal corporation.

(Any irrigation district organized in the state of Idaho must meet with the approval of a board of county commissioners and the office of the state engineer before any bond of the district may be issued.) You are familiar with the petition for the organization which is passed on by the county commissioners, then the engineering department makes an examination of the project and reports to the county commissioners, who are powerless to do anything until this report is received. After the district is organized a general plan of its proposed operation must be submitted to the state engineer for his approval and that plan must conform to the state engineer's idea of good engineering practice. So that we have legislation which gives the state, through one of its departments, power to veto the

whole proposition. I submit that if the state engineer's office does its duty in the steps preliminary to the adoption of a general plan of proposed operations, that an irrigation district bond should be received by the state as security for deposits of its money made by its treasurer.

One reason why irrigation district bonds do not have higher standing is because the state will not receive those bonds or other interest bearing securities the same as it receives bonds and warrants of cities and school districts which depend upon the irrigation district for their livelihood.

The legislation proposed would be perfectly sound because the state itself, through its engineering department, and the county where the district is organized, through its board of county commissioners, are required in the performance of official duties to carefully examine the matters relating to the organization of the proposed district and if it is not a sound project, to refuse favorable action. When the state has gone that far it would seem only fair that its paternal attitude should be extended to help in preserving the life of the district by the enactment into a law of permission to bankers to use the securities as other public and private corporate securities, as defined in the depository law.

EXTENSIVE LAND FRAUDS ATTEMPTED

The state legislature of Idaho has forwarded to Congress a joint resolution setting out that there is strong evidence to indicate that lands already applied for under the stock-raising homestead act, recently passed, are sought by dummy entrymen acting in the interest of wealthy corporations, firms, and individuals engaged in cattle and sheep raising.

Secretary of the Interior Lane has received a number of communications from individuals in the western states making similar charges, and the indications are that extensive land frauds are being attempted under the law.

The act, like other homestead laws, was designed to encourage the making of individual homes upon the public domain, and because applicable to a poorer character of lands, four times the area allowed to be entered under the original homestead law was fixed as the maximum, but both the law and the regulations clearly and fully require that these homesteads must be made for homes in good faith, and for the use and benefit of the individual making the entry.

The secretary has directed a vigorous investigation and prosecution of fraudulent claims. One who enters land, either directly or indirectly, for the benefit of other persons or corporations, will not only have his entry canceled and forfeit his homestead right, but will be subject to criminal prosecution for perjury, and upon conviction may be fined not more than \$2,000 and imprisoned not exceeding five years.

Officers of the land department state that similar frauds were attempted by large ranch owners when the so-called Kinkaid law was passed, applying to lands in western Nebraska. Hundreds of fraudulent entries were made in this area for the benefit of cattle men, but vigorous prosecution by the department resulted in the cancellation of the



CONCRETE IN IRRIGATION CANAL CONSTRUCTION
Concrete-Lined Main Canal of the Modesto Irrigation District, California

entries and ultimately the lands in this area have passed into the hands of real homesteaders, who have built up a prosperous agricultural and stock-raising community.

Subscribe for Irrigation Age, \$1.00 a Year

NEWS NOTES FROM IRRIGATION PROJECTS OF THE COUNTRY

Arizona

A. J. Holtom, former irrigation manager of the reclamation project, Phoenix, Ariz., has been transferred from the Salt river valley project to the Colorado river investigation service. He will make his headquarters temporarily in Phoenix, but his work will be confined exclusively hereafter to the Gila basin, that river being a tributary of the Colorado.

W. M. Reed, chief of the irrigation department, and J. R. T. Reeves, superintendent of irrigation of the department of the interior, visited various projects in Arizona recently on their way to California.

California

The petition to the supervisors for the organization of the Jacinto irrigation district, near Willows, now lacks only three signatures of title holders, which, it is believed, will be obtained within the next two weeks. At the last election the organization of the district failed by one vote.

With only 16 dissenting votes out of a total of 200 cast on the question of formation of the district, the Fair Oaks irrigation district was recently organized and officers were elected.

The Miller & Lux Corporation has signed an agreement with the Madera Irrigation Bureau to join in the formation of an irrigation district. The agreement was signed in San Francisco recently and outlines the basis under which the firm will work for the formation of the district. Certain of their lands are excluded from the district and an agreement has been reached regarding the amount of water from the San Joaquin river that Miller & Lux are willing that the proposed district should have.

C. E. Steinigul was re-elected president of the South San Joaquin irrigation district recently, and S. L. Steele was elected secretary, to succeed Charles A. Proudfit. C. W. Moore will succeed Steele as superintendent of the district.

Old and new directors and the members of the land owners' advisory committee are making a tour of the Anderson-Cottonwood irrigation district and will look over the work done, and determine, if possible, what changes may be made in the plans so that the district will not have to raise \$513,546 to complete work, as reported by State Engineer McClure. It is certain that the directors will decide soon what amount of bonds shall be submitted to land owners to be voted upon. It is the general opinion that it will be best to vote the whole amount, and then sell only as many

bonds as may be needed. This assumes that the cost may be reduced materially.

The Keno irrigation canal near Klamath Falls, Ore., has been leased by the government to the California-Oregon Power Company of that city for a period of ten years. The lease provides that improvements may be made in the canal by the company, and also permits the company to erect a dam in Link river near the head of the river and just before the outlet of Upper Klamath lake.

All five members of the board of directors of the Turlock irrigation district visited Sacramento recently, where they attended a meeting of the California Irrigation Districts Association. The screening of irrigation canals to preserve fish and other legislation pending before the legislature was considered and acted upon by the association.

Heavy rains during February will mean thousands of dollars to the farmers of Stanislaus county.

Formation of proposed irrigation districts may be initiated on petition of 500 property owners within the projected district, providing they represent at least 20 per cent of the land value, under the terms of Senator Maddox's bill amending the present laws, which passed the Senate recently.

W. H. Shry has been named as chairman, and Oscar Weatherby, secretary, of the land owners of the Deer Creek, Saucelito and Poplar districts, in their organization of an association to protect their irrigation rights against the Terra Bella irrigation district. There were twenty-five land owners at the preliminary meeting held in February. There is a fear that when the many deep wells which will supply the Terra Bella irrigation water have been developed it may affect the flow in wells of the districts named.

A compromise has been effected between the property owners in the Lafayette district, southwest of Lodi, on the proposal to form a Wright irrigation district. Instead of forming the district, a plan is on foot to sign a five-year contract with the Stockton-Mokelumne Canal Company, which will increase the acreage under their ditches by 10,000 acres at a cost of \$2.50 per acre.

According to an announcement made by Project Manager J. G. Camp the operation and maintenance charge in the first and second units of the Klamath irrigation project will be 85 cents an acre this year. This is a re-

duction of 15 cents an acre over last year's charge.

A delegation of Scott valley residents, among whom is Supervisor W. D. Mathews of Fort Jones, have presented a petition to the board of supervisors stating they will appear before the board on April 2 and ask that an election be called to have an irrigation district formed to comprise 40,000 acres. They plan to take the water from Scott river, which flows through the land, and carry it in a ditch that will be twenty miles in length when completed.

The Turlock irrigation district board of directors has gone on record as favoring the retention of practically all existing irrigation legislation in California and as discouraging virtually every bill which has been submitted for passage in the present session of the California legislature.

Elliott & Horne Company of Los Angeles report a brisk demand for the \$1,400,000 bonds of the Lindsay-Strathmore irrigation district for which they were the successful bidders. The issue has been approved by the State Irrigation Bond Commission and the bonds carry the certificate of the state controller. At offering prices they return to the investor a net yield of 5.60 to 5.75 per cent, according to maturities.

Harlan & Harlan, contractors of Williams, have about completed the development work on the Blevins-Mallon project on what is known as the Harbison-Kitchen ranch of 26,000 acres. Irrigation ditches and canals, together with other improvements, have so far advanced that the tenants are ready to plant rice crops for the ensuing season.

Articles of incorporation of the Red Rock Irrigation Company of Red Rock, Lassen county, with a capitalization of \$20,000, were filed recently in the office of the secretary of state. The object of the company is to supply water to residents of the district for both irrigation and domestic purposes.

The Natomas Company of California has applied to the state railroad commission for permission to appropriate 50 cubic feet per second of the waters of the Sacramento river in Sacramento county for irrigation purposes. Some of the data given in the application is as follows: A concrete intake in the river leads to a 60-inch steel pipe controlled by valve leading into sump; one 38-inch centrifugal pump with 40-inch suction pipe 58 feet long with 38-inch discharge pipe 70 feet long discharging into concrete stand pipe feeding 48-inch concrete

pipe. The main pipe line will be $5\frac{1}{2}$ miles long and there is proposed 17 miles of laterals. The number of acres to be irrigated is given as 6,600 and the estimated cost at \$120,000.

Plans for the organization of an irrigation district, comprising 40,000 acres of land in Scott valley, have been completed and will be forwarded to State Engineer W. F. McClure for approval. The petition to the board of supervisors of Siskiyou county asking an election for the organization of the district is nearly completed, as it has more than the required number of signatures of land owners. It will be presented to the board in about two weeks. The land owners propose to take water out of Scott river, a stream with a magnificent unfailing supply of water, and carry it through a ditch twenty miles to the lands to be irrigated. It is estimated the cost of the system will be comparatively small in comparison with the large acreage it will cover.

Oakdale people are up in arms with the people of Eugene over the proposed abandonment of the 26-mile road. The new reservoir of the South San Joaquin irrigation district flows over the road, or rather, the water will cover the road when the reservoir is full. A petition has already been sent to the supervisors protesting against abandoning this road and demanding that the shallow part of the reservoir be bridged for the accommodation of the people.

Irrigation projects involving thousands of acres of agricultural lands are under way, according to applications filed recently with the state water commission. One of the largest is described in an application filed by Charles W. Landis for an appropriation from the Mokelumne river. The application asks for 2,000 cubic feet of water per second for the irrigation of 100,000 acres at a cost estimated at \$500,000. A dam for the impounding of 120,000 acre feet of water is planned. The land to be irrigated is embraced in the Dry Creek irrigation project.

The River Farms Company of San Francisco has filed six applications for appropriations from the Sacramento river to irrigate 12,601 acres. It is estimated the work will cost \$83,000.

An application for 7,500 acre feet of water from Stone Corral creek in Colusa county is asked by the Esperanza Land Company of New York for the irrigation of 4,812 acres at an approximate cost of \$250,000.

Edward Fletcher of San Diego has applied for an appropriation from Santa Ysabel creek in San Diego county for the development of hydroelectric power. A dam 110 feet high and 800 feet long is planned. The cost of the project is given as \$350,000.

Colorado

Superintendent Powell of the Fort Lyon Canal Company, near Las Ani-

mas, reports that despite the low stage of the river during February, a total of 10,300 acre feet of water was delivered to the farmers. The run of water during the month varied from 110 second feet to 200 for the greater part of the month, coming up to 400 feet the last day of the month. For the first few days of the month the run averaged around 400 feet. The farmers are taking advantage of the run to effectually wet their winter wheat and alfalfa.

The *Sterling Democrat* states that Attorney T. E. Munson is in Fort Morgan trying the case of Dickman vs. The North Sterling Irrigation District. Mr. Munson appeared for the district. This is the second trial of the case. At the former hearing a Morgan county jury, on Dickman's plea for damages account of seepage from the intake ditch, awarded Dickman more than he claimed. The case was taken to the Supreme Court and a decision was rendered setting the verdict aside and remanding the case for retrial.

Professor House of Fort Collins Agricultural College, accompanied by A. J. Luginbill, secretary of the Arkansas Valley Ditch Association, Mark Denson, superintendent and engineer of the Holbrook irrigation district, B. A. Shelton, extensive stock feeder, and A. J. Grom and Robert Hansen, prominent farmers of the Holbrook valley, made a trip of inspection over the Holbrook valley recently, looking into the problem of preventing lands from becoming seepage in that locality and providing means by which drainage can be installed to reclaim lands which have already become seepy. The professor gave an interesting lecture to one of the largest and most interesting audiences that ever assembled in the town hall at Cheraw. People from all parts of the Arkansas valley attended.

The verdict of the jury of the District Court at Fort Morgan in the cases of Dickman and Veronica Gehrig against the North Sterling Irrigation Company was in favor of the complainants. The two cases of the complainants were consolidated for trial. Dickman was awarded \$2,500 and Veronica Gehrig \$1,200. The complaints were made several years ago by Dickman and Gehrig alleging damage resulting from seepage of the reservoir. Three years ago the court awarded Dickman \$6,400 and Gehrig \$4,200, but the cases were reversed and dismissed. Allen & Webster, Denver attorneys, handled the case for the complainants and Munson & Munson of Sterling for the irrigation company.

A record price for non-irrigated land for the northern part of the state was set in Loveland recently when 160 acres sold for \$60 per acre. Ninety-six hundred dollars was paid by William Rustler to Mrs. Mary Hollingshead, who took it as a homestead eleven years ago. The 160 acres will average forty bushels of wheat per acre, and has been farmed by Rustler for the last three years.

Montana

Articles of incorporation have been filed of the Woodlin Farms Company, owned and controlled by four St. Paul men, who propose to farm a tract of 400 acres of irrigated land just east of Thomson Falls. H. A. Abernethy, a St. Paul attorney, will remove here to look after the enterprise. The 400 acres will be cropped this year, it is stated.

W. W. Schlect, who for the past four years has been in charge of the Milk river irrigation project, has left for Denver, having been ordered to Arizona to superintend a job for the reclamation service. Mr. Schlect engineered the work at Vandalia, Mont., where one of the largest dams in the state was constructed. G. E. Stranton from Saco will take charge of the local project.

The Supply Ditch Company, which for the past twenty years has been doing business in the Bitter Root valley, has been reincorporated for forty years, its corporate life having expired. The concern operates a very successful irrigation project, the water being obtained from the Bitter Root river.

The Missoula Chamber of Commerce has received a letter from Wilburn Fairchild, a member of the Washington state legislature, asking indorsement of a plan through which he says 100,000,000 acres of arid land could be reclaimed. Mr. Fairchild's plan is that the congress of the United States enact a law creating an irrigation commission, which should have its operating headquarters in the western country. The working details should be generally on the plan of the Panama Canal commission. Extensive reclamation work should then be carried out through the west.

The United States reclamation service has received proposals for the construction of canals and structures on the Sun river irrigation project, Montana, involving about 71,000 cubic yards of excavation, 480 cubic yards of reinforced concrete, the laying of 3,300 linear feet of concrete pipe, and the placing in wooden structures of about 70,000 feet b. m. lumber. The work is located about thirty miles northwest of Great Falls, Mont., between the towns of Bole, Sloan and Cordova, on the Choteau branch of the Great Northern Railway, and Fairfield and Ashuelot, on the Choteau branch of the C., M. & St. P. Railway. Bids were opened at the office of the United States reclamation service at Fort Shaw, Mont., on March 29.

Unanimously opposed to the irrigation of their farms, farmers of the south half of the Greenfield bench have decided to form a permanent organization whose sole object will be to have the land definitely declared dry land to the end that this part of the bench may be eliminated from the Sun river irrigation projects. The farmers insist that they have had just as good crops without irrigation as

with it, and that the lesser cost of production on dry farms will more than compensate for any unfavorable years that may come.

It is probable that a nitrate plant will be constructed at a site in the Big Horn canyon, says a letter from John J. Harris, president of the Big Horn Canyon and Irrigation Company, who is in Washington, D. C., on business. He says he has met the secretaries of war and the interior and that they and the secretary of agriculture will visit Montana to inspect the site. It is understood two nitrate plants will be constructed in the United States, one in the south and the other in the west. Mr. Harris' opinion is that the Big Horn canyon has a good chance to land the western plum. Mr. Harris is going to New York in an effort to raise money for a power plant.

Oregon

It is reported from Washington, under date of February 20, that the Umatilla irrigation project gets \$157,000 and the Klamath project \$239,000. No new project in Oregon is authorized. Others are: Yakima project, \$1,144,000; Okanogan project, \$32,000; Boise project, \$396,000; Minidoka project, \$222,000; King Hill project, Idaho (new), \$200,000.

An irrigation system is scheduled to be installed near Crane, Ore., the water to be derived from Malheur lake, five miles southwest of Crane. Surveys are being made for the main ditches and a pumping plant on the shore of the lake, electric power to be developed on the Malheur river above Drewsey. Last September, J. E. Johnson, a well known engineer of Vale, accompanied by J. P. Congdon, formerly a consulting engineer of the Oregon Short Line, visited this section and made the statement that they were interested in an electric power project on the Malheur river and proposed to furnish power for irrigation purposes for this portion of the Harney valley. The pumping plant project is now materializing.

Ten thousand acres of timber land, irrigable land and grazing land in the Klamath Indian reservation, in southern Oregon, are soon to be offered for sale. The land will be sold in 120 separate tracts. The territory to be sold comprises the estates of deceased Indians and of those who, because of age, are in need of funds and unable to derive an income from their property. The land will first be appraised and then opened to bids, which must be equal to or above the appraised value. Under this procedure the land usually goes for \$10 an acre or less. The agricultural lands in the reservation have been found especially adapted to the raising of alfalfa and clover. They are not, as a rule, productive of grains. Irrigation is soon to be employed on 141,000 acres of the reservation.

A little more than a year ago residents of the North Unit irrigation project in Jefferson county formed

an irrigation district. Government engineers, in making a preliminary survey of the project, estimated that the cost would be approximately \$25 an acre to get water over 90,000 acres of land. Financiers and irrigation experts, who have made an examination of this district, claim the proposition is feasible. Manager J. W. Brewer of The Dalles Chamber of Commerce is an enthusiastic booster for the North Unit project. He says the ultimate completion of the work would mean a great deal to The Dalles, as the land is fertile and productive when under irrigation. Thousands of tons of products needed by manufacturing industries could be raised on this land, thus solving to a great extent the difficulties now encountered by these plants in securing a sufficient supply of vegetables and berries.

Twenty-six new farms will be started at Boardman, Ore., as the first results of the opening of the second unit of the West extension. Eighteen homesteads were taken and six tracts of private and railroad land were bought. Every tract contained from 35 to 40 acres of irrigable land for which water is ready. Each tract is supplied with a concrete turnout from concrete lined canals of the government system.

Utah

Plans for reclaiming a large area in Iron county by means of an irrigation project have been placed in the hands of W. D. Beers, state engineer, by a group of California capitalists, headed by F. C. N. Graydon of Salt Lake. The plan is to divert the water which now empties into Navaho lake and by means of tunnels run it into the headwaters of Coal creek. The project would reclaim 5,000 acres of land.

The determination of vested water rights was discussed by President Mathonihah Thomas, recently elected president of the newly formed Utah Irrigation and Drainage Congress, before that body at its annual convention, just held at the Utah Agricultural College. The pioneers established three things in their settlement of the water question in Utah, said Mr. Thomas. They established the ideas of the state ownership of water, state control of water. And insisted on the beneficial and economic use of water. All rational irrigation legislation must be based upon these three principles, and we must come back to them before we can expect any permanent solution of the water question in Utah.

Full details of the plan of J. H. Manson and associates for irrigation projects in Carbon county will not be announced until the new water rights commission, appointed by Governor Simon Bamberger, gets under way and makes decision.

The plans in general, however, have been disclosed. Mr. Manson has made application with W. D. Beers, state engineer, for 50 second feet of water, which is a large application, to be taken out of Price river at the

point just south of Colton where Fish creek and White river join. His application states that he will construct a 50,000-foot channel and pipe line. He will be entitled, under his application, if it is granted, to the waters of the Colton springs.

Preparations to contest the water filings made by C. F. Felt in behalf of the Salisbury interests of Salt Lake on the flood waters of the north fork of the Ogden river were announced recently by representatives of Ogden city and several private canal companies. Mr. Felt has filed on sufficient water to irrigate 18,000 acres of Willard bench lands, the plan being to siphon the water over the divide into Dry canyon.

Provided Governor Simon Bamberger signs House Bill 91, introduced by Representative Orson Cazier, irrigation experts stated recently, this measure, sent to the governor, will open the way for the expenditure of from \$6,000,000 to \$7,000,000 by the federal government and the irrigation of from 120,000 to 200,000 acres of land in the Tooele, Cedar and Rush valleys. Of the entire amount of land to be reclaimed, 64,000 acres are in Salt Lake county, according to Thomas L. Allen, secretary of the Utah Conservation Commission, who is reviewing the proposition thoroughly in his report soon to be submitted to the governor.

The department of irrigation and drainage at the agricultural college, convinced that Utah will never obtain the highest use of its water supply without trained men to take part in the management and operation of its irrigation systems, will give a course in irrigation management.

Approximately 5,000 acres of land in Duchesne county is to be irrigated, with the approval of W. D. Beers, state engineer, according to arrangements made recently.

New Mexico

Progress on the construction of the Las Vegas irrigation project is being made more rapidly than had been hoped for. One hundred and twenty-eight men are employed there, and as soon as spring opens up more will be obtained.

The contractors have been hampered more or less by inability to get desirable men who would stick at their jobs.

Two "dinky" railroads are in operation and a big steam shovel is kept busy plowing up dirt to be placed on the dam site. The concrete core in the center of the dam is rapidly being covered.

Contractor R. C. Storrie, a San Francisco millionaire, who was seriously injured while working at the dam several weeks ago, is recovering. He was taken to San Francisco soon after the accident. He will not lose his eyesight, as had been feared.

As a result of the abandonment of operations by the Portales Power and Irrigation Company, eight complete

pumping plants have been purchased by as many Roosevelt county farmers and ranchers, who were formerly supplied with power by the Portales company.

The first sale of state land under the new "thirty-year" or "deferred payment plan" enacted by the recent legislature took place at Taos last week, when State Land Commissioner Robert P. Ervien sold at public auction 20,716 acres of land in the Red river district in the northern part of Taos county.

Idaho

I. B. Perrine, the pioneer of irrigation in the Twin Falls section, has in charge another large irrigation scheme for the Twin Falls country. Arrangements have been made to irrigate 24,000 acres of land south and southwest of the town of Milner and south of the town of Murtaugh, and eventually to enlarge the system to cover 40,000 acres.

It is a pumping project and at present a 1,000-horsepower dynamo is being installed, but it will take many more such engines to furnish power for the entire project.

The legislature may be asked by Governor Alexander to convey title gratis to 10,000 acres of state land to the Gem irrigation district in Owyhee county, it was announced recently by members of the lower house. The chief executive has told several men that he would prefer to give the Gem district the state lands embraced within the confines of that project rather than sign a bill appropriating money for the maintenance of the state lands.

Big Malad irrigation dam, under construction 12 miles north of Malad at a cost of \$125,000, will be completed about June 1. The dam will make a lake a mile long by half a mile wide and will irrigate 8,000 acres.

There were several advanced steps taken in irrigation legislation in Idaho recently. Besides throwing statutory safeguards about contracts to be made between the state and Carey act projects promoting companies and taking steps to give the settlers on these projects greater protection, the legislature made a number of amendments to the present laws by giving the state engineer authority to clean up his water permits, providing for appeals from his decisions to the district court and calling for an investigation and survey of the irrigation and water resources of the state. In addition, the state virtually unloaded two of the irrigation projects in which it had been interested. It passed a law authorizing the governor to deed the King Hill and King Hill Extension projects to the United States government. This project was purchased by the state at public auction. The reclamation service of the interior department is now going to have charge.

Washington

"Every acre of 100,000 acres of land in the Quincy valley, Grant county, offered for sale because of delinquent water assessments in the Quincy irrigation project, and fractions of acres in some instances, were bought at a public sale conducted by the county treasurer at Ephrata today," said Fred W. Anderson, of the Anderson Mortgage and Investment Company, on his return from the scene recently.

"The entire area brought about \$2,000 by estimate, the taxes being generally about a cent an acre, and the treasurer having no right to accept more than the claims for taxes."

The vote of the water users of Peshastin creek was practically unanimous in favoring the creation of the Peshastin irrigation district, says a Wenatchee paper. The vote stood 55 to 11. This is another step favorable to the settlement of the water troubles of all those getting water from Peshastin creek. The district will include water users under the Peshastin, Pioneer, Beecher and Gibbs ditches and all riparian rights out of Peshastin creek.

After representatives of the United States reclamation service had thoroughly investigated snow conditions at the head waters of the Yakima and Naches rivers and measurements had been taken of the depth of water now in the reservoirs, Project Manager R. K. Tiffany announces that expressed fear of a water shortage in the valley this year is unfounded, notwithstanding the light snowfall of the winter. All comparisons were made between conditions as they now are and as they existed on corresponding dates in 1915, the only year that a shortage has existed.

The passing of amendments to the state irrigation district law, broadening the scope of the act, will result in spending \$50,000 on the Sunnyside project alone in the way of betterments, according to Project Manager R. K. Tiffany, who helped to draw the amendments. The amendments provide for the forming of districts within the larger project, which may issue bonds and make improvements. Mr. Tiffany says that many laterals will be concreted and metal flumes installed on different parts of the project between now and the opening of the 1918 irrigation season.

In addition to the 4,000 acres included in the Grandview irrigation district, which will be opened this year, the reclamation service is making preparations to open an additional 2,000-acre unit adjoining it on the east. Money for this unit will be available in July. The first machinery for the Grandview project is being installed and water will be available soon after the irrigating season opens.

May 1 will be the twenty-first anniversary of the opening of the first irrigation canal on the Sequim prairie, which is now the largest district of the kind in western Washington, with 12,000 acres watered by the Dungeness river.

Texas

The Texas legislature passed a bill providing for a general irrigation code and a bill authorizing commissioners' courts to establish irrigation districts.

A report of the sale of the San Benito Land & Water Company's irrigation plant and other holdings near San Benito was filed in the federal district court at Houston recently, with a motion for the confirmation of the sale, which would take the company's property out of receivership. The plant was sold for a cash consideration of \$150,000 and the assumption of \$200,000 indebtedness, and was bought by trustees for bondholders. It is now proposed by people living near the irrigation canal to issue bonds to the amount of \$600,000 and purchase the plant from the present owners.

The general irrigation bill, which strengthens the present irrigation law, was signed March 10 by Governor Ferguson. The governor also signed the house bill authorizing commissioners' courts to create and establish districts for irrigation purposes; the house bill providing that sand and other deposits taken from raising the grade of salt flats of Corpus Christi shall be exempt from the provisions of chapters 68 and 154.

South Dakota

Four thousand acres of irrigation land in the vicinity of Belle Fourche, which recently was opened to settlement in accordance with an order of the secretary of the interior, rapidly is being entered. The land is subject to entry in 80-acre tracts. The entrymen and entrywomen are charged \$2.25 per acre at the time when entry is made, and an additional sum of \$42.25 per acre will have to be paid in fifteen equal annual payments. Those who have entered the lands are preparing to make them produce crops during the coming season. The opening to settlement of these lands will add greatly to the crop production of this territory.

Nebraska

The first irrigation district bonds ever bought by the state of Nebraska were bought over the protest of State Treasurer G. E. Hall. Governor Neville, Attorney-General Reed, Land Commissioner Shumway and Secretary of State Pool, members of the board of educational lands and funds of the state, bought irrigation bonds to the amount of \$46,000 as an investment for educational funds. Treasurer Hall, who is a member of this board, protested.

The purchase was completed Feb. 24, when Secretary of State Pool affixed his signature and the seal of the state to each bond. The brokers who sold the bonds to the state paid a fee of \$260 for the signature of the secretary of state. The bonds bear 6 per cent interest. In the rate of interest this is the best bargain the state has received in many a year.

Miscellaneous

The secretary of the interior has issued a public notice for the 114 pumping extension, gravity unit, Minidoka irrigation project, Idaho, announcing a construction charge of \$42 per irrigable acre for lands entered subject to the provisions of the reclamation law, and \$52 per irrigable acre for state and deeded lands and lands not entered subject to the reclamation law. These construction charges include the drainage charge of \$12.

The United States reclamation service is asking for proposals for the construction of canals on the Shoshone irrigation project, Wyoming, involving about 30,000 cubic yards of excavation. The work is located near Mantua, Wyo., on the C., B. & Q. railroad.

Bids will be opened at the office of the United States Reclamation Service, Powell, Wyo., April 18, 1917.

The secretary of the interior has announced that the annual operation and maintenance charges for the irrigation season of 1917, and thereafter until further notice, against all lands of the Tieton unit, Yakima irrigation project, Washington, under public notice, shall be as follows: A minimum charge of \$1 per irrigable

acre, whether water is used thereon or not, which will permit the delivery of not to exceed one acre-foot of water per irrigable acre, and 75 cents per acre-foot for all additional quantities. All operation and maintenance charges will be due and payable on March 1 of each year for the preceding irrigation season.

The secretary of the interior has announced that water will be furnished during the irrigation season of 1917 to irrigable lands not now cov-

ered by public notice in Ts. 21 to 23 N., Rs. 51 to 53 W., 6 P. M., Nebraska, from the North Platte irrigation system. These lands lie under what is known as the Low Line Canal. The construction charge will be \$55 per irrigable acre. Water-right application must be made to the project manager, United States Reclamation Service, at Mitchell, Neb., upon forms provided for that purpose, and no water will be furnished to any of these lands except under such application. The operation and maintenance

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If you want to keep in touch with all sides of the Reclamation Problem send \$1.00 for one year's subscription to the Irrigation Age, 30 North Dearborn Street, Chicago.

charge for the irrigation season of 1917, and thereafter until further notice, shall be as follows: Thirty-five cents per acre-foot for all water delivered prior to and including June 30, and 70 cents per acre-foot for all water delivered after June 30; provided, that there shall be a minimum charge of one dollar per irrigable acre, whether water is used thereon or not. All operation and maintenance charges are due and payable on March 1 following the irrigation season, except that when the original water-right application is filed after August 15 in any year, the first payment of such charge becomes due March 1 of the second year thereafter.

The secretary of the interior has announced that the annual operation and maintenance charges for the irrigation season of 1917, and thereafter until further notice, against all lands of the Truckee Carson irrigation project, Nevada, under public notice, shall be as follows: A minimum charge of 80 cents per irrigable acre, whether water is used thereon or not, which charge will permit the delivery of not to exceed three acre-feet of water per irrigable acre upon lands of the Fernley and Hazen benches shown upon a map on file in the project office, and not to exceed one and one-half acre-feet per irrigable acre upon the other lands of the project; and that additional water up to a limit of one acre-foot per irrigable acre will be furnished for 20 cents per acre-foot; and that further additional water up to a limit of one acre-foot per irrigable acre will be furnished for 30 cents per acre-foot, and all further quantities for 50 cents per acre-foot.

The secretary of the interior has announced that the annual operation and maintenance charges for the irrigation season of 1917, and thereafter until further notice, against all lands of the Umatilla irrigation project, Oregon, under public notice, shall be as follows: For lands of the west extension, a minimum charge of \$1.50 per irrigable acre, and for all other lands a minimum charge of \$1.40 per irrigable acre, whether water is used thereon or not, which minimum charge in each case will entitle the water user to four acre-feet of water per irrigable acre. Additional supplies will be furnished for 15 cents per acre-foot.

One of the things upon which Governor Neville laid deepest stress in his campaign was the necessity of making adequate provision for carrying on the litigation necessary to establish the rights of Nebraska irrigationists to the waters that flow into the western part of the state as against those of later water claimants in states higher up these streams.

This is a question of mighty import to that large and growing section of the state of Nebraska in which irrigation has built up a rich empire. It is a question involving millions annually of profit to the state on the one hand or disaster and ruin on the other; so says Governor Neville.

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Thirty-Second Year

THE IRRIGATION AGE

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No. 7

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With which is Merged

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THE IRRIGATION ERA

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Official organ Federation of Tree Growing Clubs of
America. D. H. Anderson, Secretary.

The Executive Committee of the National Fed-
eration of Water Users' Association has taken action
whereby THE IRRIGATION AGE is created the official
organ of this vast organization, representing 1,000-
000 persons on the government irrigation projects.

Federal Farm Loan Controversy

In our correspondence department
appears a letter from Mr. O. E.
Farnham, Secretary of the Belle
Fourche Water Users Association,
in which he intimates that Judge
King or the Department of the In-
terior opposed an amendment to the Federal Farm
Loan Act, which would have given the Water Users
aid.

It is only fair to Judge King to say that while
in conversation with him recently and when the
matter was discussed he emphatically disclaimed
having taken the stand suggested by Mr. Farnham.

We hope to publish Judge King's disclaimer in
our issue of June.

Move to Protect Irrigation Structures

Congressman Taylor of Colorado,
chairman of the house committee
on irrigation, conferred recently
with Secretary Lane regarding the
protection of Government irrigation
projects during these times of un-
rest and danger.

Secretary Lane informed him that plans are
perfected for guarding the projects and that he will
ask Congress for an appropriation of \$6,000,000 to
expedite placing water on project lands which will
be leased in order to augment the food and forage
supply of the west. The suggestion by Congress-
man Taylor is a good one as great damage could
be done by dynamiting any one of the larger dams.

This would not only mean the loss of the cost of
construction but would also represent incalculable
loss in crop values on land supplied by the reser-
voirs.

Suggestions About Reclaiming New Projects

We are presenting in this issue an
an address by Judge William Rufus
King, Chief Counsel, U. S. Reclama-
tion Service before the International
Irrigation Congress, El Paso, Texas.
Judge King offers suggestions about
how new reclamation projects may be financed and
constructed and the paper as a whole is exceedingly
interesting, so much so in fact, as to command the
attention of all interested in western development
and the reclamation of land now lying dormant.

It would require no extravagant conjecture to
liken it to the Chamberlain-Smith Bill now before
Congress. It is possible that this subject was dis-
cussed by the author of the bill and Judge King
which would account for the similarity of ideas.

In the opinion of many Judge King is the bright-
est mind in the reclamation service, and while the
IRRIGATION AGE differs materially on many points
with the chief counsel, it is inclined to give him
credit for a wide knowledge of irrigation affairs
and possibilities.

This impels us to suggest that if the present
heads of the reclamation service had been in power
in 1902 the conditions under which the work was
carried on would not have developed and there
would have been greater harmony all around.

Great Development In Montana

Over one half million dollars worth of irrigated land has been sold in a limited area near Great Falls, Montana, within the past few months and the demand appears to be increasing. A large per cent of the buyers are farmers from Northern Illinois and Southern Wisconsin and this brings to our attention the fact that Montana has shown more activity in colonization affairs during the past year than any other western state, with the possible exception of Idaho. This is due, no doubt, to soil and climatic conditions coupled with a lot of good advertising on the part of the railroads.

The Great Northern Railroad has been especially fortunate in inducing settlers to locate along its line, and this brings to mind the fact that the officials of that road are cautious in handling prospective colonists as the colonization department does not hesitate to advise against settlement on land that is not up to standard in productiveness or where water, when necessary for irrigation, is not to be obtained in sufficient quantities to guarantee crop results. This move on the part of the Great Northern is commendatory and could be profitably copied by colonization companies throughout the country.

Klamath Water Users Bring Suit For Rights

The Klamath Water Users Association, Klamath Falls Oregon, has decided to institute suit in an effort to prevent the operation of the contract recently made between Secretary of the Interior Lane and the California-Oregon Power company of that place, whereby the secretary leased to the power company the Keno irrigation canal and also granted them a right to construct a dam across Link River at the lower end of Upper Klamath Lake at the head of the river.

There has always been opposition on the Pacific slope to the encroachments of the California-Oregon Power company. It is the impression of all who are in anyway familiar with the facts that this organization is attempting to absorb all of the hydraulic power on the coast, and judging from the caution and secretiveness of their movements there is no doubt more or less base for this impression, hence the antagonism. It would appear, therefore, that Secretary Lane is facing a serious condition unless he can show that the lease of power to so grasping an organization in no way infringes on the rights of the public or the settlers under the Klamath Falls project in particular. This matter was discussed with some of the officials of the Water Users Association at the time of the writer's visit to that section about two weeks ago and a strong feeling exists against the secretary's action.

This suit will no doubt bring all the facts to the surface and further developments in the case will be presented in future issues of THE IRRIGATION AGE.

Good Prospects In West

The publisher of the IRRIGATION AGE returned recently from an extended western trip which covered over 7,000 miles and much territory embraced in the reclamation projects controlled by the Government.

A general air of prosperity pervades the entire territory covered, and were it not for the extremely backward spring it could be said that never in the history of the west have been presented better prospects for large crops and a certainty of good prices.

A particularly noticeable feature of this trip was the large shipments of farm and heavy ranch machinery. At almost every junction point the freight houses and platforms are "stacked high" with every kind of farm implements and, apparently no former season has witnessed such heavy shipments of farm tractors, all of which leads one to believe that the irrigated west will do its share toward solving the food problem that is disturbing the public mind.

Some irrigated areas indicate unrest owing to uncertainty concerning the Government's attitude about the cost of construction, but there are indications that the reclamation service officials are inclined to a broader view in their decisions and this will eventually lead to some sort of a compromise which will be fair to both the settler and the Government.

Some of the more notable features of this trip will be explained in future issues of the IRRIGATION AGE.

MUST ASSERT RIPARIAN RIGHTS

Irrigation waters diverted from rivers for public benefit cannot be curtailed by an upper riparian owner who has permitted his rights to lapse over a long period of time. Upon this dictum, the supreme court of California overruled the lower courts and ordered the James Canal Company not to impair the supply of water taken from the San Joaquin river by the San Joaquin and Kings River Canal Company which operates in Merced, Fresno and Stanislaus counties.

Since 1872 the latter company has taken water from the river near its junction with the Fresno slough and supplied with it 18,000 acres of land. The James company, owning thousands of acres riparian to the Fresno slough, began taking water from the river above the headgates of the plaintiff company, seriously impairing the available supply of the plaintiff company. Suit was immediately filed in 1898 for a writ of mandate against the James company to compel it to cease its operations. The case has been buffeted between courts since that time.



Judge King
Washington, D. C.

HOW RECLAMATION PROJECTS MAY BE FINANCED AND CONSTRUCTED

ADDRESS OF HON. WILL R. KING, AT THE INTERNATIONAL IRRIGATION CONGRESS, EL PASO, TEXAS, OCTOBER 17, 1916, ON HOW NEW RECLAMATION PROJECTS MAY BE FINANCED AND CONSTRUCTED

(STENOGRAPHICALLY REPORTED)

Ladies and Gentle men: I will not ask you to believe it, but notwithstanding I am appearing before you again on the program; I do not speak merely in order to hear myself talk, at least I have made myself think so. Having had many years' experience in addressing juries and various other bodies, I recovered from the "long-winded" speaking fever years ago. I assure you that it has "run its course." I so often had time called on me in court when I had to obey, that I acquired the habit of not speaking over time. I am not certain as to my time limit now, but whenever you think I am nearing border line I trust you will sound the bell, so generously provided for informing speakers when their time is up, and should I not close at once just throw a snowball at me.

Someone was heard to remark before this meeting was called to order that he wished we had an audience that would fill this large hall. But that does not worry me in the least. I feel on that point much like the minister I once knew, who, when he was told that a larger audience should have turned out to hear him, responded that he always delivered



Cement Construction on Irrigation Work.

Construction View on the Ridenbaugh Canal, Idaho, Placing and Finishing Bottom.



Cement Construction on Irrigation Work.

Templates, Used to Gauge the Cross Section When Trimming the Excavation.

his best sermons on such occasions, because as he said when but few came to hear him he knew they certainly would appreciate it, or they too would not have been there. Consequently, I am not discouraged in the least by reason of the fact that all of this immense hall is not filled this afternoon. Last night someone remarked that he wished this Congress had a larger attendance, such as we had when our Congress convened here about ten years ago, but I think we have no cause to complain on that point.

True, the attendance at this Congress does not equal in number the delegates at the Irrigation Congress of 1905; nor has the attendance been so large in recent years as in the early history of the Congress for the first few years after that date, following the enact-

ment of the Reclamation Law. But that can be easily accounted for and the reasons therefor in no way cast any cloud upon either the success of this Congress or the beneficent purpose for which it was created. Let it be remembered that during the early days of its existence, especially following the date of the Reclamation Act, the enthusiasm

for the reclamation of arid lands "ran high." And why? The reason for it is clear. There were millions in the Reclamation Fund then, awaiting the readiness of the Government for the construction of irrigation projects. None had been built. Sixteen states were clamoring for projects for which the funds on hands were to be expended. Later the work was begun. The sites were selected. Projects were undertaken in fifteen of the sixteen states. Texas was brought under the Reclamation Act by special act of Congress. Construction work was begun in that state also; all as a result of the passage of the Reclamation Law brought about through the education and enthusiasm developed by the many years' work of the annual sessions of the National Irrigation Congress, as well as those of various western states.

There are now about twenty-five projects under way, many of them completed. Over one hundred and twenty-five million dollars have been invested in them. On most of them the people are contented. They have received even more than at first anticipated. Prior to all this each of these localities had representatives here. Now there is less occasion for their presence. At any rate that is the way many of them view it. Those attending now are largely of the number expecting and hoping for new projects, while the hundreds of others of former years were seeking Government aid are at home looking after and enjoying the farms given them as a result of the beneficent aid received through the Government as a result of their united efforts from year to year in the irrigation Congress.

In view of these circumstances I think the Congress is to be congratulated on its good work in the past and has no cause to complain as to the limited attendance. In fact, I think we have a large attendance, when all the facts are considered. All doubtless realize that the Reclamation Fund is becoming more limited from year to year, that practically all the fund is required to complete the projects now under way. I take it, therefore, one of the questions of vital interest to the representatives here from the unreclaimed sections of the arid states is, how shall this fund be replenished, what means can be devised by which the many untouched meritorious projects, now unproductive and lying in waste, may be undertaken? I have been asked to take a few minutes of your time in which to present my views upon how this may be done.

I believe this to be a question of utmost importance not only to the west, but to the entire nation as well, and that now is the time to begin to solve it. This point was well and very appropriately made and stated by Hon. A. A. Jones, representing the President in the opening of this Congress, when he, in substance, said that one of the big national problems with which we are now confronted is the question of financing the building of new reclamation projects and that we are reaching a critical period in the history of the Reclamation Service, and that the time is at hand when questions as to how more projects may be constructed must arise.

As I have stated, there has been invested, thus far, in national irrigation projects, something over one hundred and twenty-five million dollars, and

we probably have enough money coming in from time to time to complete the projects now in process of construction. But thus far no steps have definitely been taken towards providing a further fund for the reclamation of other lands, of which there are many. I doubt if there is anyone within the hearing of my voice who cannot point to some area in his vicinity or within his knowledge that might be successfully reclaimed if there were a fund with which to reclaim it.

And so the question arises: How shall that be done?

I remember in 1906 I was on the Resolutions Committee of the Irrigation Congress held at Boise, Idaho, and that I filed a minority report, favoring the recommendation to Congress of a method by which moneys could be raised, or by which a special fund of one hundred million dollars could be provided or made available in addition to the Reclamation Fund, for the purpose of building irrigation projects when the Reclamation Fund should become exhausted. But the report failed of adoption. The Reclamation Fund, however, has lasted much longer than we expected at that time.

There are several ways by which this most desirable additional fund might be brought into existence. In the first place, the Government might deem it of sufficient importance to aid, as it did in the building of the Panama Canal, by issuing bonds at a low rate of interest, and then loaning this money to the people at a low rate of interest. Provision should be made for the return of the principal within the time in which the bonds would become due. The Government would thus, without depletion of its treasury, receive the benefit of the public improvement, the development of waste country, the increased taxation on property, and many other values that would accrue, some of which were mentioned last evening.

I am not saying that that is the most practicable plan under present conditions, but that it is a feasible plan, and that if the Government should issue bonds at a low rate of interest for this purpose, as it did for building the Panama Canal and other improvements in the past, and at the same time feel assured that the money would be returned to the treasury, there ought to be no objection to it.

But what **should** be and what **can** be are two different questions. The time, however, will come, I think, when this can be done if found necessary, but we do not want to wait for that time, we want some of the benefits while we live; we want to see the remaining extensive areas of arid lands, as well as the swamp lands, reclaimed and converted into productive farms during our time, while we ourselves may view and receive the benefits of the improved conditions as they come along.

If it were left to us, this would perhaps be the first method we would think of adopting, but we are not the Congress of the United States. Our Congress here is more limited in its powers, hence we can only suggest and recommend.

I concur in what was said in the opening of this Congress by ex-Secretary Jones to the effect, that when we become acquainted with the members of our Congress at Washington we will have more confidence in our Congressmen than perhaps we

have had at a distance. The prejudice stirred up against members of Congress comes from the fact that we do not fully understand them, and I think, as stated by Mr. Secretary Jones, whenever we convince Congress we are right or that we have a safe proposition, we will find them with us. The question then arises: What proposition can we advance which will convince them of its feasibility? How can we obtain the best results at the earliest date?

I have heard suggested, as a second plan, that an estimate be made of the actual total value of the investments which the Government has made in all these various reclamation projects, and that such estimated value be treated as an asset upon which to procure a Government loan. There are many able advocates of that policy.

Then there is a third plan, to the effect that the Government make a loan to the Reclamation Service—something like the twenty million dollar loan already in use—of say fifteen to twenty millions annually, to be repaid by moneys received from the sale of public lands, together with the construction charges as collected from the completed projects upon which public notices have been and will be issued, and that the loan be limited to that amount annually.

This would certainly be a safe proposition for the Government if the total annual expenditures for the work should be limited to that of the past and present extent, for the service only expends in construction work from twelve to fifteen million dollars annually. And at that rate we have reached a point where that much money soon will be annually returned. That would be another way of carrying out the original purpose of the Reclamation Law—the creating of a revolving fund, the investing of the money received from the sale of public lands in such a manner as eventually to return it for use in the building of new projects, continuing thus until all the public lands are reclaimed; the only difference being that under this plan we would not have to await the actual return of the moneys invested, before the construction of new projects.

That strikes me as a very feasible plan.

A fourth plan of reclamation is being strongly urged, and that is the irrigation district plan. The idea is to have the Government make the surveys and report upon the feasibility of the project, and that no project be constructed under the plan until after the engineers representing the Interior Department have made a report and pronounced the project feasible; then let each irrigation district float its own bonds, and by use of money thus raised run its own affairs and build its own project.

That plan would bring it within the private enterprise systems spoken of last evening, except that the Government, through its engineers, would be responsible (morally) for the feasibility of the plan, though it would not guarantee the success of the plan and would incur no legal liability. The success of the project under such plan would depend upon the local management, and proper application of the private capital thus secured. There are many adherents to that theory and I believe some such plan would prove feasible. It is subject, however, to the disadvantage, under such circum-

stances, that the rate of interest would perhaps reach from five to six per cent, or one or two per cent higher than if the Government should either guarantee or make the loan. I think it is safe to say that if that plan were followed the money could perhaps be borrowed for five per cent, after the project, upon the report of the Government engineers, should be pronounced feasible by the Secretary of the Interior.

But I have in mind what I deem a still better and more efficient plan, and one which would enable every project to construct itself without financial assistance from the Government.

Now, ladies and gentlemen, in what I have said and in what I will say on this occasion, I want it clearly understood that I am not speaking for the Department. I have not heard the Secretary of the Interior express himself on any of these plans—I don't know what his views are on the question, hence do not want anything I may say upon this subject to be construed as expressing the views of the Department. I am here as a delegate from my state, appointed by the Governor to represent the state of Oregon in this Congress, and am therefore speaking to you as a private citizen from Oregon (on invitation extended me by one of your committees yesterday morning), hoping that I may throw a few rays of light upon the proposed legislative canvas and in that way lend my humble aid to my good state and national government as well.

Now, reverting to what I started to say about this other plan: Assume, for example, that you should find an available water supply for a certain section of the country, and should desire to construct an irrigation project, or a project for the reclamation of arid lands or swamp lands, or both as the case may be. You should first be required to procure the surveys by the departmental engineers; then if approved and the plan should be found feasible, you would by the Department then be required to organize an irrigation district under the state laws on the subject. After your district is organized you would petition the Secretary of the Interior to have engineers examine the proposed project, make the necessary surveys, estimates, etc., and report on its feasibility. In your petition you would consent to the taking over by the Government of the construction of the project and its control and management (just as the Government manages its projects at the present time), until after the major part of the funds invested are paid, at which time the project would be turned over to the directors or managers of the district. You would then issue the bonds for the amount required for the construction of the project and deliver them to the Department of the Interior. The Secretary would be authorized, by law to be enacted, to sell the bonds under a Government guarantee of both principal and interest, provided the Government is given full control of the construction and management of the project until such time as the major part of the funds thus invested should be returned.

That would be an amended form of what is known as the "Jones Bill" introduced in the Senate by Senator Jones of Washington. The principal difference between the two plans is that under the "Jones Bill," as I understand it, the Government

would only guarantee the interest on the bonds and let the irrigation district build the project without Government supervision, and exclusively handle the funds raised under such guarantee. But under the plan I have to offer the Government would be not only behind both principal and interest, but would, at the same time be amply protected, as it would have charge of the construction work and exclusive control of the management, together with the collection of the construction, operation and maintenance charges.

Should this plan be followed, each irrigation district, or municipality would build its own project; each, as might be said, would "fly with its own wings." No appeal would have to be made from time to time for funds; no money would have to be advanced by the Government, except perhaps a small fund—say from twenty-five to fifty thousand dollars—with which to make the surveys and which eventually would be returned by the project. Every available project would build itself without the necessity of having to call upon the Government for money before doing so. There would be no necessity for going to Congress from year to year seeking appropriations or anything of that kind. With the Government's aid thus secured, the people could in this manner float their own bonds, and secure the required funds at a low rate of interest, of from three to three and a half, and not to exceed four per cent per annum.

Now, we have listened to an able discussion on the Rural Credits Bill, under which money is loaned with which to handle your crops at the rate of five per cent. Is it unreasonable then to ask for a loan with which to place the water upon the farm with which to raise these crops, at the same or a lower rate of interest? Perhaps the better system would be to let the rate be the same as provided in the Rural Credits Bill, five per cent, and set aside two per cent annually of the receipts under that rate as a sinking fund with which to redeem the principal, which under what is known as the amortization plan would pay off the principal within about thirty-five years. This would only extend the present reclamation payment period a few more years. Instead of the Government advancing you the use of money for twenty years at what is in effect five per cent interest and then making you a present of the principal, as the real estate firms mentioned last evening advertised the Government is doing under the Reclamation Law, this plan would only be an extension of about ten or twelve years in which to pay interest and be made a present of the principal. (Gong rings.)

JUDGE KING. What was that? (Laughter.) Well, ladies and gentlemen, I understand that the first bell rings three minutes before you are through. But fortunately it rang just as I was through. Now, I am ready to close for fear someone will throw at me the snowball which I invited a few minutes ago. I thank you. (Applause.)

JUDGE CARROL B. GRAVES, of Washington: Before Judge King takes his seat, may I make sure of his position and inquire whether in his suggested modified form of the "Jones Bill" it is proposed that the Government guarantee the bonds or only the interest on the bonds?

JUDGE KING: I thank Judge Graves for calling my attention to that feature. I could very easily have utilized my other three minutes by further clarifying that point. In response, will say that under the plan I last discussed the Government would guarantee both the principal and interest. The guaranteeing of the interest alone is another proposition which I think would be practicable, except that it might make a difference of one-half to one and a half per cent in the interest to be paid.

That is another one of the proposed plans, and it constitutes one of the main features of the "Jones Bill." I have heard that plan advocated and extensively discussed, and I believe if the Government would guarantee the interest on the bonds and not the principal, that within itself, would enable the procurement of the necessary funds and at a rate of not to exceed four per cent (provided the Government controlled the project), because every man who might invest in bonds would know that he would at least get back the principal in interest. The interest in the end would amount to as much as the principal, provided the time of payment is made twenty-five years at four per cent, or twenty years at five per cent. The purchaser of the bonds could say he was taking chances on losing the principal or running the risk of losing the interest. In either event he would in the end have returned to him the full sum advanced. Or you could call it a guarantee that he would receive half the principal and half the interest; whichever plan you want to term it, the final result would be the same. You may call it either the payment of the principal or payment of the interest, whichever term would be preferable, providing he should lose either or lose anything at all.

I think, in practice, it will be found that when they shall have paid the interest for the full period of time it is not likely that the district will permit itself to default and lose all moneys it has invested. So, under either proposition, I think the investor would feel safe and the plan would prove a success.

The principal criticism I have of the "Jones Bill" is that the project is not carried on under government supervision and that, under that plan, we might become confronted with some of the dangers with which the people have had to contend in the cases of corporate or private enterprises, to which I referred in our debate last evening.

Does that answer your question?

JUDGE GRAVES: Yes, sir. May I just indulge in one remark one minute?

CHAIRMAN TRUE: Certainly.

JUDGE GRAVES: I am not saying that as a matter of discussion, but as a matter of suggestion. After the Government has examined the project and pronounced it feasible, if it then undertakes as a matter of Government function to guarantee the interest, why should it have any control over the operation of the canal? I will grant that it might have supervision over the construction of the work so as to see that the plans which it had approved were carried out.

Now, I have this thought in mind: In my state and in most of our sister states there is a custom that once bonds are floated and sold, the collection of taxes to pay the interest and principal is not vested in the hands of the district officers. When

the taxes are assessed, the county treasurer, or whoever may be the tax collecting officer of the county, collects those taxes the same as he collects taxes for general purposes. Further, if any officer of the district neglects to perform a duty, or a function, then the state officers may be compelled by law to perform the neglected duty.

I know of one instance that happened some years ago where the Board of Directors purposely neglected, on account of the stringent times, to levy a tax to pay interest upon those bonds and the Supreme Court mandamusd the Board of County Commissioners and county officers to make those collections, and they did make them.

If the Government guarantee the payment of the interest provided the purchasers take the bonds and the Government has had an opportunity of investigating the project in the first instance, why not, to use the language of Judge King, permit our districts to "fly with their own wings?" That is one suggestion upon which Judge King and I are very little apart and I hope after he has listened to me as patiently as I have had the pleasure of listening to him, we will get still closer together. (Applause.)

JUDGE KING: Mr. Chairman, if I may have about two minutes, I will give my response to that. (Request granted.) I will admit that we are not very far apart; our difference goes only to the practicability of it.

There are some districts where you can safely turn the entire management over to the parties with more than a reasonable degree of safety; but there are other districts where the management would fall into incompetent hands and prove a failure, just as it has in some very good districts within the knowledge of several within the hearing of my voice.

Now, take the Minidoka project in Idaho—that is a Government project operating under the irrigation district plan. That is an irrigation district where they have not repaid to the Government more than half of the funds invested, but the Reclamation Service, with the consent of the Secretary, has turned the management of that district over to the district itself—the operation and maintenance of it. That might be done in many instances. But remember, the United States necessarily holds a string upon that, so that if not properly managed and handled, the the Government may be protected in the investment made. And in all cases a right should be, and is, reserved by which the Government may again take charge, if the contract should not be complied with, until the moneys advanced are returned to the Reclamation Fund. Now, with that qualification, this might be done in some districts in the manner suggested by Judge Graves. I do not mean to be understood as saying that you must necessarily have more than half of the funds. It should be left within the discretion of the Secretary to determine when to turn the management over to the local self-government—the irrigation district, but I think that under no circumstances should a district be given the exclusive management, without a string upon it being retained by the United States until all funds are returned. So, after all, as Judge Graves has suggested, there is not so very much difference between us.

CHAIRMAN TRUE: Apparently Judge Graves and Judge King did not quite finish their debates last night, for which reason we have let them go on in order to get it all out of their respective systems. I now doubt if there shall be anything left for them to argue about. In fact, it looks like they are about to "agree on a verdict." (Laughter and applause.)

CORRESPONDENCE

An Open Letter From the Secretary of the Belle Fourche Water Users Association

O. E. Farnham

Newell, S. Dak., April 18, 1917.

Mr. D. H. Anderson,

Editor, IRRIGATION AGE, Chicago.

Dear Mr. Anderson:

From the time that the Federal Farm Loan Act was introduced, the water users on Federal Reclamation Projects have been hopeful that Congress would make some provision whereby they would be enabled to make loans under the terms of the Act.

Some members of the Committee that drafted the bill seemed to think that it could be so interpreted as to permit of loans being made to the farmers on the reclamation projects, and it was hoped that the Land Board would so interpret the law. Delegations of water users appeared before the Board at various times and presented their case, but the final decision of the Board seems to be against us.

When it became a settled fact that the Board could not permit such loans under the terms of the Act, Congressman Kinkaid of Nebraska introduced a bill amending the Act to permit loans to be made on lands under the Federal Reclamation Projects,

a copy of which I am enclosing herewith. I am also enclosing a copy of a letter that Congressman Kinkaid addressed to the secretary of our local Federal Farm Loan Association recently as to the result of his efforts.

The only objection to Mr. Kinkaid's bill, as I understand from his letter, came from the Department of the Interior. Why the department should be opposed to this amendment which provides the Federal water users an opportunity to procure the necessary capital to develop and stock their farms, and thus be enabled at a much earlier period to meet their payments to the Government, is a question which certainly needs some explanation by the department. It is a well known fact among the water users on the projects that the chief counsel of the Reclamation Service has prescribed a form of local organization for the water users on the various projects and that their ultimate success depends upon their early adoption of or submission to his ideas along that line, in the opinion of the chief counsel.

I understand that the Federal Land Board has made a ruling which will permit loans on certain

irrigated lands included within irrigation districts where the water right cost is not exorbitant and is collected in the same manner as state taxes are collected. In other words, in order to enjoy the benefits of the Farm Loan Act, the water users on the various projects must abandon their present organizations prescribed for them by a former administration of the Reclamation Service and perfected in accordance with the corporation laws of the respective states and adopt the form of organization now prescribed by the chief counsel of the Reclamation Service. If there were any advantages in the latter form of organization, it would necessarily take considerable time to make the change. In the meantime, the farmers on the Federal projects must plod along as best they can, until a majority of them on each project reaches that stage where he is absolutely forced to make a loan somewhere, and must bow to the wishes of the chief counsel, who admits that he is the attorney for all the water users, and vote against their better or unbiased judgment for an irrigation district.

But what is the result of this arbitrary attitude of the Department of the Interior influenced by the chief counsel? The Government in the midst of this national crisis is urging especially the irrigation farmers to increase their acreage of food products to assist somewhat in relieving the stringent food situation. Had the department permitted the Kinkaid amendment to pass, so that the Federal Land Board could now make the loans asked for by the farmers on these projects, many thousands of acres would be seeded this spring which now must remain idle and uncultivated for the reason that the occupants cannot get the credit to purchase seed and the necessary equipment to farm them.

It is all right to try out the pet ideas of cranks placed in high positions and permit those who are vitally concerned to adopt them as they are found practical and desirable, but it is exceedingly undemocratic, to say the least, to force upon citizens an undesirable or unknown form of organization, especially by the methods usually adopted by the service. It is the same old story, if you cannot meet your payments when due, no matter what the circumstances are, you must encumber your posterity with another \$10 an acre.

You may publish such portions of this communication as you desire. Before closing, I desire to say, however, that the Belle Fourche project has

fared better in my opinion than most of the other projects, and it is apparently because of the fact, that we have been insistent upon a partial recognition at least of our rights as water users, and have strenuously opposed any increase of charges. The decisions of the Central Review Board clearly indicate that these rights may very easily be surrendered or waived by the execution of new contracts. The water users therefore should proceed with exceeding caution in any readjustments of their organizations. Very truly yours,

O. E. FARNHAM.

(Copy of Bill referred to in Mr. Farnham's letter:)

BE IT ENACTED by the Senate and House of Representatives of the United States of America, in Congress assembled:

That clause first of section twelve of the Federal farm-loan act, approved July 17, 1916, be and the same is hereby amended to read as follows:

"First, Said loans shall be secured by duly recorded first mortgages on farm lands within the land bank district within which the bank is situated; Provided, that loans are authorized to be made on lands under reclamation projects, entered under the Reclamation Act, approved June 17, 1902, after the issuance of patent, and on lands under private ownership, brought under such reclamation projects, pursuant to said reclamation act, when the owner shall have acquired an appurtenant water right therefor, notwithstanding installment water right payments remain yet to be paid as to either of said two classes of land; also on irrigated lands, other than hereinabove specified, subject to bonded indebtedness, in cases where payments thereof are collected under the general taxing powers of the state; but loans on the several classes of lands herein specified shall be made in accordance with rules and regulations to be prescribed by the Federal Farm Loan Board."

(Copy of Kinkaid letter referred to by Mr. Farnham:)

"House of Representatives U. S.

"Washington, D. C.,

"April 5, 1917.

"George A. Ross, Esq.,

"Newell, S. D.

"My dear Mr. Ross: Your esteemed favor of the 27th ult. is before me and I note the inquiry you make as to whether the Farm Loan Act permits of making loans to entrymen under irrigation projects, assuming final proof has been made. Will say, for some time it was a mooted question, but it is now virtually settled that it is not permissible under the law to make such loans. Accordingly, at the last session I introduced a bill to amend the law so as to permit the making of loans to entrymen in such cases, but the Department was against my bill. However, the officials claim they favor some such a provision and I hope we will yet pass an amendment permitting such loans to be made. I remain,

"Very cordially,

"M. P. KINKAID."

SIMPLE CONCRETE STEP CONSTRUCTION

Steps are not only subject to hard usage, but when constructed of wood with the lower part in contact with the ground and subject to alternate wetting and drying, decay is very rapid, making them unsafe and dangerous. Steps at the rear or kitchen entrance of the house encounter especially hard usage, but it is a very easy matter to have them durable and safe by constructing them of concrete. The three forms consist merely of that many boxes open at top and bottom and also at the end adjoining the door-sill.

A rise of 8 inches and a tread of 10 inches will be found convenient. For this reason the height of

each box should be 8 inches, since every box will form a step. All of the boxes should be of the same width, but each one is 10 inches shorter than the one beneath it, thus forming the tread of the step. If the steps are few in number and not too wide, 1-inch boards will be stiff enough to hold the concrete without bulging, but if there is any doubt about this it is better to use 2-inch plank. The concrete for the steps should be mixed in the proportion of 1 bag of Portland cement to 2½ cubic feet of clean coarse sand to 4 cubic feet of crushed rock or pebbles. The earth beneath the steps should be excavated to a depth of 6 inches below

the surface, the excavation being the exact size of the bottom of the steps. Make sure that the earth is level and compact at the bottom of the excavation. Place the largest box in position around the edge of the excavation, staking it in place at two or three points to prevent shifting. Level the first box very carefully by means of a carpenter's spirit level. The concrete, mixed rather dry, should be deposited in the box and thoroughly tamped and compacted until moisture rises to the surface. Work or spade the concrete thoroughly along the sides of the forms so as to produce a smooth surface. At the front end of the box, where the concrete becomes the tread, the surface of the concrete is carefully leveled off and smoothed with a trowel for a distance of about twelve inches from the outer edge. Immediately after this is done the second and smaller box is placed on top of the first one, being fastened thereto by a few nails through the upright cleats shown in the drawing. The nails must not be so long as to project through the forms and into the concrete. Fill the second box with concrete immediately, being careful that no dirt or other foreign matter falls or collects on the surface of the first batch of concrete, as this would prevent a good bond between the two layers.

Finish this step or slab in exactly the same manner as described for the first step. The last or third step is constructed in exactly the same manner as those previously described.

The brace between the two back cleats is for the purpose of preventing the boards from spreading at the side next to the wall. The outer surface of the top step is carefully leveled off with a straight-edge and finished by troweling to a smooth surface. Excessive troweling, however, must be avoided. Not more than a half hour should elapse between placing the concrete for each step so that the concrete first deposited will not harden and set up before the next form is filled. After the steps are about one week old, the forms may be removed and the steps used. After the forms are removed any roughness or irregularities may be smoothed down and the surface of the entire steps finally finished by rubbing with an old piece of emery wheel and water or carborundum and water. Where the work includes many steps, a hollow space is generally left under the main body of the steps to effect a saving in materials. Where this is done the platform and steps are reinforced with steel rods or heavy wire mesh to prevent cracking.

INDIVIDUAL PUMPING SYSTEMS FOR FARM IRRIGATION

The use of individual pumping plants on irrigated farms has many advantages and few drawbacks, says an article on this subject in the new Yearbook of the U. S. Department of Agriculture, and the area in the country irrigated in this way is increasing. If a farmer has a dependable supply of water and a well-designed and properly installed pumping plant, he is sure of being able to give his crops the water they need when they need it. The relative cost of individual pumping plants and the gravity supply of water is, of course, a factor of the utmost importance, but in many instances it is now cheaper for a farmer to pump his own water than to buy it delivered by a ditch by gravity.

Mechanically, it is possible to pump water from greater depths and in greater quantities than commercial considerations always make profitable. The amount of money that, from a business point of view, it is wise to expend on a pumping system can not, therefore, be stated unless all the conditions which determine the expense of pumping and the price of the resulting crops are known. In the paper already mentioned, it is said that a first-class pumping plant, including the well, with ample capacity to irrigate 160 acres of average forage crops, may be installed at a cost of from \$5,000 to \$7,000. A plant with a smaller capacity requiring the use of a reservoir may be installed for \$2,000, with \$500 or even \$1,000 additional for the reservoir.

The choice between a pumping plant of large capacity without a reservoir and one of smaller capacity with a reservoir is largely a question of the comparative cost of the larger equipment and of the reservoir. In applying irrigation water, a very small stream can not be used to advantage.

Where only limited areas are to be irrigated, therefore, it is customary either to install a pumping plant capable of delivering more water than is absolutely necessary, or else to use a smaller plant with a reservoir in which the water can be accumulated until an economical stream is available. As the farmer must pay interest on and, to a large extent, depreciation on his investment, whether the pumping plant is in continuous operation or not, he can frequently save money by installing a comparatively small pump and keeping it in more or less continuous operation.

The three types of pumping plants principally used for irrigation are the plunger or cylinder pump, the centrifugal pump, and the air-lift. As a general rule, says the article in the Yearbook, the plunger type of pump is well suited for lifting quantities of water from 100 to 500 gallons per minute from depths beyond 50 feet. For quantities of from 500 to 2,000 gallons per minute at greater depths than 50 feet, the vertical centrifugal pump is better suited.

In installing a pumping plant, massive and well-built foundations are necessary for proper operation. Weak foundations permit vibration and consequent loss of power and unnecessary wear and tear on the machinery. Concrete, thoroughly mixed, and composed ordinarily of one part of cement to two parts of sand and three parts of gravel, is the best material. Another point of importance is to see that the feed water in the engine-cooling system contains no sand or sediment. For the belting used in driving the pump, four materials are in common use—leather, rubber, canvas and composition. Of these, leather is to be preferred for dry climates.

NEWS NOTES FROM IRRIGATION PROJECTS OF THE COUNTRY

CALIFORNIA

Wm. Sproule, president of the Southern Pacific Railway, returned recently from a trip of inspection in the Imperial Valley and offered suggestions about protection against high water during the spring rise. He stated that much work should be done otherwise great loss would be encountered. Mr. Sproule stated that the trip has produced evidence of business activity on both sides of the Colorado River. On the Mexican side great areas are being actively farmed and Mexicali has become an active business center.

The directors of the Alta Irrigation District refused all bids for the sale of 20 acres taken by them as a result of litigation. The bids made were too low to satisfy their claim.

A definite policy for distribution of the waters belonging to the Oakdale Irrigation District is being worked out by the directors to be used this season. This plan is based on the law that each piece of property shall be entitled to receive water in proportion to the amount of taxes paid.

Contracts were let April 25 for 53 miles of irrigation ditches to take water from the main central canal of the Central Jacinto Project to 9,500 acres of the project that will be planted to rice.

A new record in the sale of irrigation bonds was made recently when a block of \$114,500 5 per cents held in the treasury of the South San Joaquin District was sold to the San Joaquin Valley Bank at .9678. The money is to be used to complete the Woodward reservoir north of Oakdale.

Fruit trees in various sections of California suffered slight damage from a frost early in April.

Work on completion of the Anderson-Cottonwood Irrigation District will be rushed to insure water to two-thirds of the district by midsummer of this year.

A Stockton paper states that the municipal bath water is to be used to irrigate the public park at Lodi.

The California assembly passed a bill recently authorizing co-operation between adjoining states in forming irrigation districts.

A complaint has been filed with the railroad commission against the Sutter-Butte Canal Company, asking repayment of excessive water tax imposed on settlers under this project.

The Paradise District contains 11,000 acres of land and the directors

put on the market May 1st a \$350,000 bond issue for development of the district.

The Board of Directors of the re-organized Happy Valley Irrigation District in Shasta County has formed plans for the purchasing of a private company operating in that community.

WASHINGTON

The Bald Hill Irrigation Company of Beaver has recently been organized with a capital of \$3,200 and Arch Patterson president and R. A. Olcott secretary and treasurer.

UTAH

The first annual gathering of the Utah Irrigation and Drainage Congress was recently held at Salt Lake City. Interesting papers were presented by President M. Thomas, W. D. Bees, state engineer; C. F. Brown, drainage engineer, and R. S. Callett of the Dry Gulch Irrigation Co. in the Uinta Basin. It is understood that these meetings will be held annually hereafter.

The Northwest Irrigation Company's Carey Act project at Woodside was recently considered by the State Land Commission in session at Salt Lake. The contract with this company has been canceled, but the segregation still stands. It was decided that it should remain so and that the incoming board be allowed the privilege of deciding as to the advisability of leaving the segregation intact.

Conversion of 150,000 acres of sage brush land in Eastern Millard County, Utah, into productive farms by means of artesian well irrigation is a project that is being worked out by the farmers in Fillmore Valley.

Construction work on a 35,000-acre reclamation project between Hurricane and St. George is soon to be started, according to Engineer Clarence Jarvis, who was in Salt Lake recently. Storage dams and a series of canals, some of them 30 miles long, are features of this project.

The state of Utah is confronted by a problem in connection with a loan of \$50,000 on land of the Green River Irrigation District at Emery, Utah. These bonds were purchased by the State Land Board in 1911 and instead of the state receiving \$3,000 interest annually, the amount actually collected in the whole period since the purchase is only \$1,986.

MONTANA

The dry farmers' side of the proposed irrigation of the Greenfield bench under the Sun River project was recently explained to members of the Great Falls Commercial Club by

a delegation of bench farmers. The contention of these men is that water will cost \$50 an acre or more, which means a total on 160 acres of \$8,000 with an additional cost of \$15 per acre more for drainage, also a maintenance cost of \$1.25 an acre, making the amount necessary to pay on a quarter section \$14,400. The impression among these farmers is that better success will result under dry farming.

Butte capitalists interested in the Flatwillow Irrigation project are ready to proceed with the work of construction. This development will add a great wealth to Fergus County. It is estimated that \$150,000 will be expended in putting the project over.

There is plenty of snow in the mountains of Montana to insure sufficient water for irrigation this season. In fact, if flood water would be conserved there is enough for several seasons.

Over a quarter of a million dollars' worth of land on the Valier irrigation project has changed hands since December, 1916.

NEBRASKA

There is a plan on foot at Minden and Holdrege to harness the Platte River under some such plan as it was proposed to do with the Laupe for water power, only the Platte idea, which is prompted by J. S. Canaday of Minden, contemplates irrigation instead of power. It is said that C. W. McConaughy of Holdrege is the father of the proposed plan.

OREGON

The Klamath Water Users' Association has decided to institute suit in an effort to prevent the operation of the contract recently made between the Secretary of the Interior and the California-Oregon Power Company of Klamath Falls, leasing to the power company the Kenō Irrigation Canal and granting to them a right to construct a dam across Link River at the head of the river. The board has taken decided steps and the development of this suit may reveal interesting features.

Attorney McColloch of Portland has taken up with State Engineer Lewis the question of having the lands of the Payette-Oregon Slope Irrigation District certified under the new law. This project covers 67,000 acres and is irrigated by pumping water from the Snake River.

The Desest Land Board of Oregon recently, after hearing from a committee of prominent citizens of Bend, decided to ask the Department of the Interior to hasten the decision on the

extension of time asked on the 74,000-acre Benham Falls project, near Bend, instead of abandoning the extension so that the department may throw the vast project open to home-stead entry.

E. C. Hopson was recently appointed receiver for the Willamette Valley Irrigated Land Company. The company was capitalized for \$200,000 and has assets of approximately \$190,000.

The Winnett Irrigation Company announces that its project, begun four years ago, will be completed this fall. The project covers 11,000 acres of land northwest of the town of Winnett.

Work on the Glen Lake irrigation project has been completed, and though very little water was used in Tobacco valley this season, next year practically all of the farmers in the valley will be using the water of the Glen ditch for irrigating their crops. The district has been bonded for \$13,000 in addition to the original amount. This is for the purpose of maintaining the system and providing for emergencies that might arise.

James W. Dunlap of Medford has filed an application with the state engineer to take water from the Rogue river to irrigate 16,000 acres. He proposes to install a pumping plant that will cost approximately \$200,000, and construct canals 16¾ miles long.

Approval of the application to irrigate 1,200 acres of land near Mt. Vernon in Grant county has been given by the state desert land board. The water is proposed to be taken from the John Day river by the Blue Mountain Irrigation Company.

Trustees of the Talent-Ashland irrigation district, recently organized, have procured the services of Contractor C. E. Bade of Medford to begin work at once on preparation for irrigation of 5,000 acres of the unit during 1917. Unappropriated water from Emigrant, Ashland and Neil creeks will be used for that purpose.

The Squaw Creek Irrigation Company of Prineville has filed application with the state public service commission for authority to increase its rates from 35 cents per acre foot to 60 cents per acre foot, contending that it has operated at a loss under the rates in effect.

C. W. Johnson, secretary of the High Line Canal district, has recently announced that the directors had granted an option on the \$5,000,000 bond issue to a syndicate headed by the Twohy Bros., contracting firm of Spokane and Portland. The option calls for the construction of the entire canal project by the syndicate, which is to take the bond issue as pay. The option is for 90 days and the syndicate must complete its examination and decide whether it wishes to exercise its option by Jan-

uary 1, 1917. The High Line Canal district, also known as the Kittitas Reclamation district, consists of over 90,000 acres in the Kittitas valley. The option calls for the completion of the entire project by March, 1919, in case the investigation proves satisfactory and the option is exercised.

The U. S. Reclamation Service has commenced excavating for the construction of the pipe lines and ditches for the Grandview irrigation district. This is a pumping project for about 5,000 acres, and all power will be developed on the canals and spillways of the Sunnyside project, mainly at the drop of the Mabton syphon feeder canal, where the pump house will be. The work will be rushed to completion this winter so that the canals will be ready for water next season.

IDAHO

The State Prison Farm of Idaho will be located near Nampa on the land owned by the state under the Government Ditch.

The application for the confirmation of the organized proceedings of the Riverside Irrigation District by the county commissioners was filed in the district court at Boise recently. This district was only recently organized.

Arrangements are being made to irrigate 24,000 acres of land east of Twin Falls, between Hanson and Milner. The water for this project will be raised by pumping from the Snake River.

Payment was made recently by E. H. Durey and the farmers and Merchants' National Bank for \$14,250 North of Nampa and Meridian irrigation bonds recently offered for sale. The bonds bear 6 per cent interest and run for 20 years.

WASHINGTON

The Lewiston Land and Water Company has placed a guard, night and day, about the large reservoirs supplying water for irrigation and domestic users on the Lewiston orchard tracts.

The Indian Reclamation Department has sent instructions to Superintendent Holt at North Yakima to co-operate with Superintendent Don M. Carr to get the largest possible acreage put in crops this year to assist in the general preparedness campaign.

MISCELLANEOUS

The Hunter Irrigation Canal, twelve miles south of Crowley, La., started pumping recently to get the canal system filled with water in time for the rice irrigation.

Word from Williston, N. D., says the Federal million-dollar irrigation project will not be operated this year, this decision having been reached at a recent meeting of the Williston Water Users' Association. This project has had a stormy career.

Irrigation will save the crops at the State Reformatory of Kansas, regardless of whether rain comes or not. All arrangements are made for taking care of the crops by this system.

The Chilean Congress has made appropriation for the construction of an irrigation canal which it is expected will add about 100,000 acres of valuable agricultural lands to the available supply of Chile.

The U. S. Reclamation Service is asking for proposals for furnishing 75,000 barrels of Portland cement, f. o. b. cars at the works of the bidder.

Bids will be opened at the office of the U. S. Reclamation Service, Tramway Building, Denver Colo., on May 23, 1917.

The Secretary of the Interior has issued public notice providing for an increase in the cost of construction on the Umatilla irrigation project, Oregon, of \$13 per irrigable acre. This charge is made to meet the cost of supplemental construction in District 13.

The lands which are subject to the increased charge lie in T. 5 N., R. 29 E., W. M., Secs. 29 and 30. This extra charge will be paid in additional annual installments after the last of those now payable under the Reclamation Extension Act, the first annual installment being \$6.00 per irrigable acre, and the last installment \$7.00 per irrigable acre.

The U. S. Reclamation Service is asking for proposals for the construction of 5.7 miles of main canal on the Fort Laramie Unit, North Platte irrigation project, Nebraska-Wyoming, involving about 536,500 cubic yards of excavation. The work is located near the Bridgeport-Guernsey line of C. B. & Q. Ry., in the vicinity of Torrington, Wyoming.

Bids will be opened at the office of the U. S. Reclamation Service, Fort Laramie, Wyoming, on June 6, 1917.

The U. S. Reclamation Service is asking for proposals for the construction of canals on the Rio Grande irrigation project, New Mexico-Texas, involving about 196,000 cubic yards of excavation. The work is located near Garfield, New Mexico.

Bids will be opened at the office of the U. S. Reclamation Service, El Paso, Texas, on May 23, 1917.

The Secretary of the Interior has announced that the operation and maintenance charges for the South Side Pumping Unit of the Minidoka irrigation project, Idaho, for the irrigation season of 1917, and thereafter until further notice, shall be as follows: Forty-five cents per acre-foot for all water delivered after June 5, and on or before October 20, provided, however, that there shall be a minimum charge of \$1.25 against each irrigable acre whether water is used thereon or not, which minimum charge will be applied in payment of

the charges under the acre-foot rates.

Until further notice, after October 20 of each season no water will be furnished except upon request, and at an additional charge for each farm unit of 80 acres or fraction thereof, of \$2 for each day of water service given, provided, however, that every person desiring this service shall, before receiving same, deposit with the Special Fiscal Agent of the U. S. Reclamation Service, at Burley, Idaho, a sum of money sufficient to cover the number of days that he desires water, and designate the turnout where he wishes to have the water delivered and the size of stream he will require. So far as practicable water will be delivered to each depositor for the days covered by his deposit, but whenever the aggregate deposits for any day are less than \$200, delivery of water will cease and not thereafter be resumed. Unused deposits will be returned to persons making same. This service will not be commenced unless deposits aggregating \$200 per day for a reasonable period shall be made prior to October 20.

The Secretary of the Interior has authorized the Reclamation Service to execute contracts for earthwork and structures, Ft. Laramie Canal, North Platte irrigation project, Neb.-Wyo.

Schedules 1, 2, 3, 4, and 6 are let to Winston Brothers Co., of Minneapolis, Minn. This contract involves the excavation of 1,148,700 cubic yards of material, 493,000 cubic yards of overhaul, the placing of 1,375 cubic yards of concrete, 114,000 pounds of reinforcing steel, 6,000 pounds of structural steel, 2,300 square yards of grouted paving, and 3,800 cubic yards of backfill and erecting superstructure of two bridges. Contract price, \$217,845.

Schedules 5 and 7 are let to MacArthur Brothers Company, of New York City. The work involves the excavation of 1,125,500 cubic yards of material, placing 1,825 cubic yards of concrete, 160,000 pounds of reinforcing steel, and 30,000 pounds of structural steel, and erecting superstructure of twelve bridges. Contract price, \$243,966.25.

The Secretary of the Interior has authorized the Reclamation Service to execute contracts for earthwork on the second unit, Frannie Division laterals, Shoshone irrigation project, Wyo.

Schedule 1, involving 24,000 cubic yards of excavation, and 10,000 cubic yards of overhaul, to H. S. Jolley, of Lovell, Wyo. Contract price, \$7,670.

Schedule 2, involving 59,800 cubic yards of excavation, and 5,000 cubic yards of overhaul, to David Lewis, of Cowley, Wyo. Contract price, \$10,610.

Schedule 3, involving 70,000 cubic yards of excavation, and 5,000 cubic yards of overhaul, to Tebbs & Taggart, of Cowley, Wyo. Contract price, \$19,700.

Schedule 4, involving 71,000 cubic yards of excavation, and 5,000 cubic

yards of overhaul, to N. O. Mortensen, of Cowley, Wyo. Contract price, \$9,440.

The Secretary of the Interior has authorized the Reclamation Service to accept the proposal of Walter S. Dickey, of Kansas City, Mo., for furnishing sewer pipe for use in connection with the Shoshone irrigation project, Wyo. The total contract price is \$8,109.70.

The U. S. Reclamation Service is asking for proposals for furnishing Lateral Turnout Gates for Sun River irrigation project, Mont., and Boise irrigation project, Idaho. The material to be furnished will require about fifteen tons of metal work.

Bids will be opened at the office of the U. S. Reclamation Service, Denver, Colo., on June 1, 1917.

The Secretary of the Interior has authorized the award of contract for excavation and earth lining on Nelson Reservoir South Canal, Milk River irrigation project, Montana, to Rolla Barnes, of Malta, Mont. The contract price is \$8,750.

The State Land Board of Idaho has announced the sale of the remaining unsold State land on the Minidoka irrigation project, Idaho. Two sales will be held, the first one at Rupert on May 21 for the lands in Minidoka County, north of the river, and the other at Burley, on May 23, covering the lands south of the river, which are in Cassia County.

The total irrigable area of the land is 2,105 acres, of which 1,180 acres are on the gravity unit, and 925 acres on the pumping unit. Most of the land is situated north and east of Marshfield. All of it is within six miles of a railroad station.

The land is sold at auction to the highest bidder. Ten per cent of the purchase price of the land must be paid on the day of sale, the balance being payable in forty years with interest at six per cent on deferred amounts. Water rights, for which application must be made at Burley, Idaho, cost \$56 per acre for lands north of the river, \$44 per acre for gravity lands south of the river, and \$57.50 per acre for pumping lands, provided the water right is applied for by May 25. After that date the price will increase five per cent.

Most of the land south of the river is a clay loam or volcanic ash. Some of it, however, is a sandy loam, as is also the land north of the river. The topography is variable. Most of it is fairly level, but an inspection of it before buying is advisable.

In addition to the farm lands, a number of town lots and acreage tracts in the First and Second Additions to Heyburn will be sold by the State, the tracts varying from two to five acres each.

The secretary of the interior has announced that the annual operation and maintenance charges for the irrigation season of 1917, and thereafter until further notice, against all lands of the Huntley irrigation project,

Montana, under public notice, shall be as follows: For lands in the third unit, 70 cents per acre-foot of water delivered during July and August, and 35 cents per acre-foot for water delivered during other months; for all other lands, \$1.10 per acre-foot for water delivered during July and August, and 60 cents per acre-foot for water delivered during other months. Provided, that there shall be a minimum charge of \$1.10 per irrigable acre for all lands, whether water is used thereon or not, which minimum charge will be credited on the amount due for water furnished at the above rates. All operation and maintenance charges are due and payable on March 1 following the irrigation season.

The secretary of the interior has issued a public notice announcing that the annual operation and maintenance charge for the irrigation season of 1917, and thereafter until further notice, against all lands in the Fort Shaw unit, Sun River irrigation project, Montana, that are under public notice, shall be a minimum charge of \$1.25 per irrigable acre, whether water is used thereon or not. This charge will permit the delivery of not to exceed one acre-foot of water per irrigable acre, and additional water will be furnished for 50 cents per irrigable acre-foot. All operation and maintenance charges will be due and payable on March 1 of each year for the preceding irrigation season.

The secretary of the interior has authorized the reclamation service to set aside certain representative tracts of land on the Yuma Mesa in Arizona for the use of the experts of the Department of Agriculture in connection with cooperative investigations to determine proper methods of handling the soil. Experimental plantings of numerous varieties of trees and shrubs will be made in order to determine those best adapted to the locality. As the region is exceptionally free from frost, the possibilities of propagating varieties from the semitropical lands of other countries will be studied.

The Yuma Mesa has long occupied the attention of growers of citrus fruits and the prospect of early irrigation is bringing numerous inquiries to the Reclamation Service at Washington, D. C.

A petition for dissolution of the receivership of the Louisiana Irrigation & Mill Company of Arcadia Parish, La., and the return of the property to its stockholders, was filed recently in the district court at Crowley, La., by Jas. Billingsley, receiver for the company. A statement was filed with the court showing that the affairs of the company have been put in a sound financial condition. The company's net profits in 1916 were more than \$142,000. This company owns about 260 miles of canals in Arcadia Parish and water about 40,000 acres through sixteen pumping plants.

Articles of incorporation have been filed by the North American Land & Timber Company, with a capital stock

of \$250,000. Headquarters of the company are located at Wilmington, Del. The purpose of the company is to drain, reclaim, irrigate and cultivate lands.

Three thousand acres of raw land in the west end of Umatilla county, Oregon, will be brought under irrigation and cultivation next season according to County Watermaster L. A. Rieneman. The land consists of 1,000 acres under the Furnish project, 1,000 acres under the Western Land and Irrigation project, 500 acres under the Umatilla project and 500 acres under the West End extension.

Land owners in the Pine Grove district, seven miles east of Klamath Falls, met recently and discussed the organization of an irrigation district and the construction of a high-line ditch from which to water their lands with water pumped from the main canal of the Klamath project. It is proposed to pump the water from the main Government canal by electricity. An irrigation district will be formed, since the Government recently let it be known that it would rather contract with an irrigation district comprising the lands of a certain section

than with the owners of the land individually.

Pumps and windmills are rapidly transforming Llano Estacado, the Staked Plains of Western Texas, into a vast irrigated farm. The vast water basin which underlies the plains was only discovered four years ago, but the development since then has been tremendous, covering nearly 1,000,000 acres.

One concern purchased 60,000 acres of land in the Plainview territory two years ago, and it is its purpose to provide water for the irrigation of all of it by the centrifugal pumping method. It has already punctured the earth with fifty-four large wells and placed a pumping plant upon each hole. The plans of the company call for the drilling of 346 more wells and the installation of that many additional pumps and engines.

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IRRIGATION BY MEANS OF CANVAS TUBE.

A very interesting contrivance was demonstrated last summer at the College farm. It consists of a long canvas tube in which are placed small brass gates, so placed that each gate will come opposite a row down which it is desired to discharge irrigation water. The tube is laid along the high part of the field, connected with the ditch at the upper end, the water runs through this tube without; the water is discharged through the gate openings in the amount desired by the irrigator, and the supply for each tube is controlled by opening the small gates in the tubes. The canvas tube decreases in size as it extends from the ditch so that the smaller head of water flowing at the extreme lower end is carried through a much smaller tube, and thereby a saving of material is obtained.

So far as the control of irrigation water is concerned this device is ideal. Further than that it is easily changed from place to place by allowing the water to run out of it and then dragging it along the ground. The only thing that will have to be watched is that it is thoroughly cleaned when irrigation ceases, because the canvas will of course in time rot, and the same care must be given a tube of this kind as is given to the ordinary canvas dam in order to preserve the same.

E. B. HOUSE,

Colorado Agricultural College,
Fort Collins, Colo.

WASTE FROM DESKS GOES INTO BRUSHES.

Waste wood in the manufacture of school desks is now being used for the backs of cheap brushes, according to the statement of the forest service.

A large manufacturer of school desks in Michigan had a considerable amount of waste material in sizes which were too short to enter into the manufacture of the smallest desks, and could not be utilized further with his machinery or in his line of work. This material was all hard maple in pieces an inch thick, a foot or so long, and about three inches wide; for a long time it had been consigned to the waste pile and sold as firewood. This waste amounted to from one thousand to fifteen hundred board feet each day. A nearby manufacturer was using practically this quantity of maple, which he was sawing up into small pieces for making the backs of cheap brushes.

Members of the forest service, investigating methods of eliminating

factory waste, conceived the idea that the blocks used by the brush factory could be readily secured from the waste of the school desk manufacturer, and on this basis got the two together. Arrangements were made so that the brush manufacturer now places orders with the other firm for its raw material and what was formerly waste is now a source of profit.

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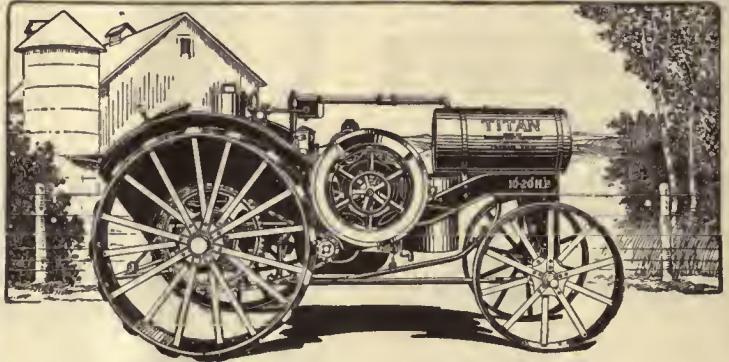
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Thirty-Second Year

THE IRRIGATION AGE

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D. H. ANDERSON, Editor

Irrigation Securities Not Affected By War

No matter what the trend of the speculative market, many authorities believe that the developments of the war will have no injurious effect upon investment securities, at least not of a permanent nature. This is particularly true of irrigation securities in the form of district bonds, according to J. Rupert Mason, of the firm of J. Rupert Mason & Co. of San Francisco.

Davis' Work on Irrigation Construction

We have received from John Wiley & Sons, New York, a new work on irrigation by Arthur Powell Davis, director U. S. Reclamation Service, entitled "Irrigation Works Constructed by the United State Government."

This work contains over 400 pages of valuable and interesting matter concerning work by the U. S. Reclamation Service and illustrates and describes all of the prominent projects including Yuma, Salt River, Oreland, Grand Valley, Uncompahgre, Boise, Minnidoka, Huntley, Lower Yellowstone, North Platte, Truckee-Carson, Rio Grande, Umatilla, Klamath, Bell Fourche, Strawberry Valley, Okanogan, Yakima and Shoshone.

Director Davis has utilized his collection of data in the preparation of this work to good advantage and the result is a finely illustrated and clearly assembled description of these vast enterprises. The book should be in the hands of every one interested in private or federal irrigation work.

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Official organ Federation of Tree Growing Clubs of America. D. H. Anderson, Secretary.

The Executive Committee of the National Federation of Water Users' Association has taken action whereby THE IRRIGATION AGE is created the official organ of this vast organization, representing 1,000,000 persons on the government irrigation projects.

May Lose Water Rights

Transfers of water rights appurtenant to one piece of land to another on Carey Act projects, after patents for the land reclaimed by irrigation companies have been issued to the state by the Federal government, may result in settlers in the Twin Falls district in Idaho losing thousands of dollars, according to information brought out when Edward Damman of Twin Falls appeared before the state land board at Boise recently.

Damman wished to file on a piece of land in the Twin Falls south side tract. He wanted to divert water that had been made appurtenant to forty acres of land to another forty following the action of the irrigation company, in cancelling the contract for water on the first forty. He said the land from which water had been withdrawn had been sold for taxes by Twin Falls county.

L. W. Wells, Carey Act agent for the federal government, was in attendance at the meeting. He informed Damman and members of the land board that the department of the interior would not permit the transfer of water rights, although they were recognized as personal property, from one piece of land to another after a patent for an irrigation project had been issued.

It was pointed out by Mr. Wells that the Twin Falls South Side company had segregated 240,000 acres of land but had sold water rights on only 200,000 acres. He said that to leave one piece of land without water and transfer the contract to an-

other forty would result in the acreage given the state by the government being cut down just that amount.

Mr. Wells was of the opinion that this practice could possibly result in many filings by one family with a single contract for water and especially if it was found that land vacated could be worked under the dry farming system.

The land board was apparently at a loss in the matter of a decision and Mr. Damman was informed that his application would be taken under consideration. The attitude of the land board leads us to believe that this question may prove an important one and in the event of a positive stand by the department of the interior serious complications may arise. In any event the outcome will be looked for with much interest.

Many Yellowstone Elk Dying

Reports of conditions which threaten the Yellowstone elk herds come to us from the reports of the forest service, United States Department of Agriculture. These reports cover Yellowstone Park and the Jackson's Hole region. The danger is said to be due to an exceptionally heavy winter snow fall and late oncoming of spring. Deep crusted snow is preventing the elk from obtaining their usual feed and the weakened animals, especially the calves are reported to be dying rapidly in spite of the large supply of hay provided by the government for such emergencies. This supply is now exhausted and bands of elk that are prevented from getting to the lower altitudes where food may be obtained will die from starvation.

The government, through the forest service, has performed good work in protecting elk and other game but the unusual long winter, such as that of 1916-1917 threw their food quantity calculations awry and the result will be a lot of bones, some fertilizer and plenty of teeth for charms for our brothers "Bill."

The writer has frequently called attention to the wanton destruction of the elk and recalls a certain canon in the Ten Sleep country, where a large band of elk was snow-bound and slaughtered by Indians and cow men, and the horns cached on the canon walls in sufficient numbers to fill a dozen hay wagons. This sort of "sport" has done more to keep the elk herds down than starvation.

Another case that came to the writer's attention during a trip into northwestern Wyoming last fall may be worth mentioning, a well known sheep man and miner who runs his bands in Jackson's hole informed him that he let his miners and herders off a half day each week to hunt elk and following our statement that his camps should be well supplied with fresh meat, he stated that he gave

the carcasses to the men but it was understood that all of the teeth fit for mounting were to be delivered to him.

Thus it will be seen that the government has conditions equally as serious as starvation, to confront in the protection of elk and other game animals.

Killed By Close Cutting

The U. S. Department of Agriculture has issued a bulletin on the subject of cutting sweet clover for hay, which contains many suggestions of value to farmers generally.

This bulletin states that examination of hundreds of acres of sweet clover in different sections of the United States during 1915 and 1916 showed that the stand on at least 50 per cent of the fields was partially or entirely killed by cutting the first crop of the second season too close to the ground.

To prevent the loss of stands the specialist says farmers should examine the fields carefully before mowing to determine the height at which the plants should be cut. At least one healthy bud or young branch should be left on each stub. In fact, the plants should be cut several inches above the young shoots or buds, as the stubble may die back from one to three inches if they are cut during damp or rainy weather.

It is possible because of the difference in the growth of sweet clover on different types of soil and because of the difference of stands in the different fields to state definitely the proper height to cut the first crop the second season when a second crop is to be expected.

When fields contain very heavy stands, fifteen to twenty-five plants to the square foot, it may be necessary to leave an eight-inch stubble. When the plants have been permitted to make a thirty-six to forty-inch growth, a five to six inch stubble usually will be sufficient to insure a second crop.

Sweet clover hay is not easy to cure and should be handled with great care to insure good color and aroma.

The writer has mentioned sweet clover many times in the columns of THE IRRIGATION AGE, during the past twenty years and has advocated its use in silos to give aroma to the contents.

A thin layer of properly cured sweet clover between each load of other silage will give tone and aroma to the entire contents.

It has been suggested several times in these columns that sweet clover if cut at exactly the right time and handled like hemp will produce a fine fiber which may prove profitable as time goes on. It is the opinion of the editor that some one, some day, will make this experiment and prove our prophecy true.

Latin America And Food Problem

John Barrett, director of the Pan-American Union, the international organization of the American Republics, has recently made the statement that the countries of Central and South America can decisively help if not completely solve the future food problem facing the United States and its European allies.

Mr. Barrett states that as proving the natural capacity of Latin-America to supply food products and the dependence of the United States and its European allies upon them that the twenty countries of Central and South America exported in

1916 to the United States and Europe foods valued at \$774,000,000. Of this grand total there went to the United States \$371,000,000 and to other countries, principally Great Britain and France \$403,000,000. While these figures represent only a small part of the total food consumption of the United States and its European allies, they show that the Latin American countries with wise co-operation and co-ordination in conserving supplies and extending production will be able to take care of and provide against that very deficit or shortage in the production of the United States and its allies which might be fatal in an ultimate crisis.

THE UNCOMPAHGRE PROJECT WINS CONCESSIONS

Messrs. Catlin, Bell, Kyle and Ira Monell of Montrose, Colorado, returned recently from Washington, where together with a number of the other members of the Uncompahgre Water Users' association they held a number of conferences with Secretary Lane on matters pertaining to the Uncompahgre reclamation project. While not getting as much as they had gone after, they seem to be well pleased with what has been accomplished by the trip back to Washington. That they put up a good fight is quite evident from the fact that Mr. Lane, at the close of the conference, complimented them on the forcible way in which they had presented their case.

Concerning the conference and the agreement reached with Mr. Lane, Mr. Catlin, who has taken a leading part in bringing the matter to a conference, has this to say:

"Secretary Lane gave us a prompt and complete hearing and went fully into all the matters of our project that we desired to present. Secretary Lane is a big and just man and is willing to do everything necessary for the success of this project. The tentative contract which you will print, gives the details of the understanding reached. We will now be able to take over and operate the full irrigation system beginning December 1, 1917. We believe the cost of maintenance and operation can be materially reduced without reduction of efficiency. The most important item for immediate consideration is the immediate preparation by everyone to use the water next year as all irrigable lands under the project must pay their proportionate share of the expense whether they use water or not. The public lands will be open for entry without delay. Everyone who desires to obtain a water right from the project, must subscribe before August 1, 1917. This requires immediate action by our people and the amount of necessary activity to get the lands in readiness for using the water next season will bring into use all the men and all the teams of the valley, great expenditures in material and for labor. Our committee was unanimous in regarding the adjustment so satisfactory that no honest complaint can be raised. All irrigable lands should be subscribed, and with no payments on cost for five years the outlook is such, in my opinion, as to wipe out all doubt and hesitancy and bring a period of

genuine prosperity such as we have not seen in this valley for many years.

"Our delegation is enthusiastic in its appreciation of the work done for us by Congressman Taylor. We want to say that Mr. Taylor is a true friend of the people of the Uncompahgre valley, and we owe a great deal to him for the splendid way he is looking after our affairs."

Mention has been made of the outstanding points in the results of the conference, but the details which are contained in a letter from Secretary Lane to Dr. McClanahan, president of the Water Users' association, will be read with much interest by all interested in development under federal projects. The letter is as follows:

Dr. Albert C. McClanahan,

President Uncompahgre Water Users' association, Delta, Colo.

My Dear Doctor: Referring to conference had with yourself and other representatives of the Water Users' association, May 22 to 26, inclusive, I have to advise as follows:

I have personally carefully examined into the evidence and arguments submitted by the Water Users' association relative to abatement of the cost of the Uncompahgre reclamation project and the general situation of the water users upon and land in the project, and in accordance with our tentative understanding, I have to advise that under existing law and conditions the best and only method which I can find for assisting in the working out of your problems is embodied in the following provisions:

1. That the project be operated for five years from December 1, 1917, by the water users, the latter to pay during that time the actual cost of operation and maintenance.

2. That at the end of that period, unless extended or modified by law, or order of the Secretary of the Interior, public notice to issue and payment of construction charges to be made in accordance with the reclamation extension act of August 13, 1914, or other applicable law.

3. That the recommendation of the Central Board of Review be adopted and \$47,370.81 be eliminated from the project cost; that the remaining cost be divided by the number of acres of private lands subject to irrigation, plus the irrigable acreage of public lands and the construction cost per

acre thereby ascertained; provided, that all private lands to be taken into consideration herein shall be subscribed before August 1, 1917. It is further understood that the association may release the subscriptions of those members having full or partial vested water rights or may make adjustments by credits, provided that the remaining lands and subscribers assume and repay the project cost.

4. That all public irrigable lands in the project shall be promptly opened to entry and water-right application under applicable laws.

5. That the Reclamation Service shall do any necessary additional construction work upon the tunnel or upon the south canal, or other project works, the cost of such necessary work to be added to the building charge.

6. That at the option of the Water Users' association the entire project and related works shall be turned over to it for operation and maintenance hereunder, or the canals and distributing systems shall so be turned over, the tunnel, diversion dam, and south canal to be maintained and operated by the United States, the annual operation and maintenance charges to be paid prorata by all lands irrigable under the project.

7. That all future expenditures by or on behalf of the United States upon the project shall be made only after consultation with the Water Users' association and in the event of failure of the Reclamation Service and the Water Users' association to agree with respect thereto, the matter shall be carried to and decided by the Secretary of the Interior.

8. The association will use its powers and resources, cumulatively, if necessary, including the power to withhold the delivery of water, to enforce the rules and regulations made by the Secretary of the Interior under the provisions of law, or by the association under its articles of incorporation and by-laws, for the proper care, operation and maintenance of the project and for carrying out the provisions of this agreement. If the enforcing of any such rules and regulations shall require the collection of any charges, penalties or interest from persons holding land the title to which has not passed out of the United States, the association shall report such cases to the Secretary of the Interior who will aid the association in enforcing such collections by the cancellation of entries and water right applications or by other means authorized by law. But failure on the part of the Secretary of the Interior to enforce such collections in such cases shall not relieve the association from the obligations assumed by it under this agreement.

9. The association shall use all practical methods to insure the economical and beneficial use of irrigation water. It shall also hold the United States harmless as to any damages which may accrue to other land or property either within or without the reservoir district growing out of the care, management, operation and maintenance of the project by the association.

10. The project and all its works and those connected with it may be inspected from time to time under the direction of the Secretary of the Interior when he shall deem it necessary to ascertain if the provisions of this agreement are being carried out and observed by the association in the

care, operation and maintenance of the project. The cost of such inspections shall be charged to the association and become due to the United States on March 1st of each year for expenditures on that account during the preceding year.

11. The association shall maintain all the works turned over to it under the provisions of this agreement in proper operating condition and make proper delivery of irrigating water to each farm unit entitled thereto, or at least as near to the farm unit as the United States is now delivering such water.

12. This agreement may be canceled or terminated by the association on March 1 of any year upon not less than one year's written notice thereof to the Secretary of the Interior. It may be amended at any time, such amendment to be ratified by a vote of the members of the association in the same manner as the original agreement, and all amendments must be approved by the Secretary of the Interior before becoming effective. This agreement may be terminated by the United States acting in that behalf by the Secretary of the Interior, at any time, by at least three months' written notice from the Secretary of the Interior in case the association fails to carry out the provisions of law relating thereto, or of this agreement, in their true intent and meaning, or if the Secretary of the Interior shall reasonably believe that the security of the United States for the repayment to it of the said construction cost, is being impaired by the failure or neglect of the association to properly care for and maintain the project. Upon the termination of this agreement, the Secretary of the Interior shall have the right to exercise all the powers in regard to the project which are vested in him by law; he may also at any time, after the execution of this agreement, take such action as he may deem proper, either by his own officers or through the association, for the collection of any charges with penalties due the United States, which may be unpaid.

13. The association will keep reasonably accurate records of water deliveries and of crops raised under the project as well as such other records as are appropriate to the interests of the project as a whole. Copies of the official county or other public records governing crop production shall be accepted under this provision.

14. The proper officers or agents of the association shall have full and free access at all reasonable times to the project books and official records of the United States relating to the construction, acquisition, care, operation and maintenance of the project, with the right at any time during office hours, to make copies of and from the same, or any of them. The proper representatives of the United States shall have similar rights in respect to the books and records of the association relating to the project and its care, management, operation and maintenance.

This offer, which is necessarily general in its terms, is, of course, contingent upon the ability of the association and the department to agree upon a definite contract which will set forth fully and in detail the understanding and agreement pertaining to the turning over of the operation and management of the project under the plan herein proposed.

I have to suggest that you cause this proposition to be submitted to a vote of the water users under the project at the earliest practicable time.

Cordially yours,

FRANKLIN K. LANE.

DRAINING IRRIGATED SHALE LAND

Factors to Be Considered by Land Owners in Installing a Successful System.

Much difficulty has been experienced by owners of irrigated shale lands in the West in installing satisfactory drainage systems. A study of this problem has now been made by the U. S. Department of Agriculture and the results of the investigation published in a professional paper, Bulletin No. 502, entitled "Drainage of Irrigated Shale Land."

The three essential factors, this publication declares, for the successful drainage of shale lands are: (1) proper location of drains; (2) sufficient depth, and (3) relief wells.

Seepage areas in shale lands occur almost invariably where pressure conditions exist and the movement of the water is upward. In only a few cases is it possible to place the drains, except at a prohibitive expense, deep enough to reach the supply of water that causes the saturation. Water-carrying zones of shale have frequently been found at depths of 30 feet below the surface. Since the movement of the water is upward through the joints and fissures in the shale, attempts to drain such areas by tile drains alone will be unsuccessful, as evidenced by the fact that flowing springs have been found within ten feet of a trench seven feet deep. Under such conditions it is necessary to supplement the tile drains with relief wells. A relief well is nothing more or less than an artesian well; that is to say, it is driven from the bottom of the tile trench, through a comparatively impervious stratum into one carrying water, and the water enters the well under pressure and is conducted to the tile drain.

The most efficient depth for relief wells, the bulletin states, has been found to range, according to local conditions, from six to twenty feet below the bottom of the tile drain. Each of these wells influences only a small area surrounding it and it is, therefore, desirable that they should be closely

spaced. In many cases there should be five or six to each 100 feet of trench. A diameter of two inches has been found sufficient for the wells and in most of the shales the wells have been installed with a soil auger, though hard strata may require the use of a churn drill.

The quantity of water developed by the system is greatly influenced by the depth of the tile drains. This never should be less than six feet, the bulletin says, and depths of from seven to eight feet are better.

To be successful, the installation of the drainage system must be preceded by a careful and complete examination of the topography and underground conditions. The drains must be located so as to tap the contributing shale features such as ridges, points, knolls, etc. Owing to the frequent irregularity of the shale formation it is often a slow and laborious process to obtain a correct idea of it. This, however, is essential if the drains are to be so placed that they will do the work for which they are designed.

The average cost of draining shale lands in the region covered by the bulletin is placed at from \$13 to \$100 an acre for the area actually affected. From 12 cents to 25 cents per linear foot of trench is the estimate for the cost of installing tile drains and relief wells. This estimate, however, does not include the cost of any material. It is based on a labor cost of 25 cents an hour.

In conclusion, the bulletin points out that once seepage trouble has developed in shale lands, the affected area increases rapidly. Furthermore, the quantity of alkali salts near the surface of the ground also increases rapidly in waterlogged lands of this type. For this reason land owners will save money and secure more satisfactory results if they install their drains at the first indication of trouble.

HIGH COST OF LIVING IS IN THE BUYING

Let the people demand Legislation to take care of the man in business who is lacking experience and knowledge in buying—is one of the solutions to the food question, the Law to apply especially to the Butcher and the Grocer. The ordinary run of business is working at a disadvantage owing to the fact that the middle man is reaping the profits and the consumer is developing "Hysteria"—one cause of the high cost of living.

Normally the general public is unable to solve the food problem, the shrewd business man or woman invites criticism, because of their knowledge of good business material the margin in business is the necessary element to create confidence in our general welfare.

The packers and the stock raisers are the balance-wheel of intelligence in our commercial and industrial centers, the food-producing elements controlled by proper methods holding one's better judgment in reserve until a better method can be advanced. No reasonable man or woman can exercise

intelligence in buying until they know some of the material facts pertaining to the system of food handling. The food producer becomes the loser if he does not properly care for his distribution, hence, the reasonable solution to the food question is the establishment of a food bureau—the food bureau to be similar to the weather bureau.

Thus the over and under production of our food supply would be properly cared for—the underlying principle of good government is in our government fulfilling its obligations to the people on a "Business Basis." Thus the reasonable solution to the food prices would be solved and a scientific distribution of our material resources along lines intelligently brought about by coming in contact with the various representatives whose duty it would be to advise with the Central Food Bureau, produced out of a natural distribution of natural resources along lines intelligently brought about by coming in contact with these various representatives whose duty it would be to advise with the Central Bureau. 121 East Forty-Third street, Chicago.

OPPORTUNITY TO MAKE A TRIAL OF GROWING GRIMM ALFALFA

Much of the common alfalfa in Illinois, Iowa, Wisconsin, Ohio, and Indiana was winter-killed last winter, while it was observed that Grimm alfalfa in some localities escaped winter killing, indicating that this variety is much more cold-resistant than the common type.

Paul P. Banker, county agent, working in the co-operative extension service of the Montana State College of Agriculture, has made arrangements to supply Grimm alfalfa seed for a trial half-acre plot at a very much reduced price to any farmer who wishes to experiment with a small plot along side of the common varieties he is already growing. Montana dryland hardy Grimm alfalfa seed ranks high in the markets of this country today. Other alfalfa seed is sold quite generally under the name

Grimm, and this fact accounts for the failures that some farmers encounter in trying to grow alfalfa. The Grimm alfalfa seed offered by Mr. Banker is the genuine state inspected dryland hardy seed. It is grown without irrigation, with a rainfall of less than fourteen inches, and with winter temperature as low as 57 degrees below zero. Farmers wishing to try out the Grimm alfalfa should write to Paul P. Banker, Harve, Montana.

We think this is an excellent opportunity for farmers in Wisconsin, Illinois and contiguous states to make a trial of growing this highly recommended hardy alfalfa.—A. M. Ten Eyck, Director Agricultural Extension Department, Emerson-Brantingham Implement Company, Rockford, Ill.

ALSIKE CLOVER FOR WET PLACES

The possibility that a continuance of the war may affect the supplies of concentrates for stock feed makes it wise at the present time to consider growing feeds rich in proteins. Of such feeds the U. S. Department of Agriculture wishes to call attention to alsike clover as a plant for low wet places. Analyses show that alsike clover hay is slightly richer in protein than red clover, and the hay is fine and well liked by stock. For dairy cattle, especially, it is an excellent feed, and a ration of alsike hay could partly replace a ration of silage and concentrates where these have been used, making a saving in concentrates. When properly cured alsike clover hay is bright colored and sweet, making it very palatable. The plant being smooth, the hay is less dusty than red clover hay. It is not advised that alsike be seeded instead of red clover or alfalfa. Where these are successfully grown the farmer would better stick to the crops he knows will do well, alsike clover can be seeded this spring with good promise of success. Where it is seeded on worn or sour upland with a grain nurse crop, there will, of course, be no cutting the same season, unless the season should be unusually wet and long, but when seeded on low, damp ground, without a nurse crop, a good cutting of hay may be expected the same season. Where the land is weedy it will be better to seed with a light seeding of oats which may be cut for hay. In this case, too, a cutting of clover hay may be expected the same season.

The department wishes especially to call attention to the wet bottoms that are often waste or weed-overgrown lands. Alsike clover thrives in such places. In many places in the South it is very successfully raised on creek bottoms. In some cases such lands are overflowed more than once in the season, and are thus risky for corn or for red clover, but alsike clover will endure an occasional spell under water and still make a hay crop when the land dries again.

In the North and West there are many swales

and wet places on which the crop kills out or which are too wet to prepare for corn. Alsike should do well on such land and return a good crop of rich hay. On the Patoka River bottoms of Indiana, for example, alsike is reported as having made two tons of hay the season of sowing.

As a rule alsike makes but one cutting, but where the land is rich and moist two cuttings may be secured in the year following seeding. Of course, only one cutting can be expected the season of seeding.

It is a good plan to seed alsike clover with timothy, with orchard grass, or with red top. When seeded alone the stems of the clover lie on the ground and make a mat that is difficult to cut. The grass serves to hold the clover up and thus makes cutting easier. The mixture is also more readily cured. A good mixture for such purpose is alsike clover, five pounds, and timothy, four pounds per acre; or alsike clover, five pounds, and orchard grass, ten pounds. Such mixtures will give most alsike clover with enough grass to hold it up. If more grass is wanted, increase the seeding of grass.

Now is the time to attend to this matter. Farmers are urged to seed alsike clover on all low lands and wet places. Some seedings will doubtless fail, but on the whole the result should be more good hay for cattle and a consequent saving of concentrates, resulting in a saving of cash to the individual and great food supplies for the country.

WESTERN CANADA IRRIGATION ASSOCIATION

"The development of irrigation interests in western Canada is illustrated by the fact that this year for the first time the convention of the Western Canada Irrigation Association will be held in the Province of Saskatchewan. In previous years it has always been held either in Alberta or British Columbia, where the advantages of irrigation have been more generally recognized. The meeting will be held at Maple Creek, August 1, 2 and 3.

LIVE STOCK IN AGRICULTURE

Reasons Why Animal Husbandry Is Essential in All Sound Systems of Farming.

Seven reasons why the keeping of live stock is essential to sound agriculture are set forth in an article by George M. Rommel in the 1916 Yearbook of the U. S. Department of Agriculture. Briefly, Mr. Rommel's seven reasons are the maintenance of soil fertility, the utilization of raw material, the need of motive power on the farm, cash income, the added attractiveness of a farm on which there is live stock, the training in business sense obtained by keeping animals, and better and more economical living for the farm family.

To maintain soil fertility, says Mr. Rommel, humus is necessary. This can be obtained from two sources—green crops plowed under, or barnyard manure. When green crops are plowed under, however, there is no direct revenue from them. By feeding these crops to live stock, valuable products that can be exchanged for cash are obtained. At the same time the manure produced by the animals retains a very large percentage of the fertilizing value of the feed. For this reason it is more economical to feed than to plow under without feeding, and the most practical source of humus is stable manure.

The farmer with live stock is from one point of view a manufacturer. He takes lean, unfinished animals and grain or forage as his raw materials and by combining them produces beef, mutton, pork, and dairy products. Like all manufacturing, this process must be conducted with skill and intelligence if it is to pay, but if the farmer possesses these qualities he derives a larger profit than he could obtain through the sale of crops and animals in the raw state. Furthermore there are many products on the farm which bring little or nothing on the market. They can, however, by skillful management be made to assist in the production of meat. The thrifty farmer makes use in this way of all roughage on his farm that would otherwise be unsalable. The cornstalks go into the silo or into the shock as cut fodder. The straw and coarse hay are utilized to the last unit of energy value. Land that cannot produce marketable crops is made to yield a certain amount of sustenance for hogs and sheep.

While in cities and factories, mechanical power is coming into more and more general use, on the

farms of the country the horse and the mule are still the chief reliance. The proper breeding, maintenance, and employment of these animal engines is a problem of the greatest importance to the farmer.

As a source of cash income, the keeping of live stock in many sections is what is known as a specialty business. In dairy districts it is the main activity, and every phase of farm management is determined by its interests. Where the principal purpose of live stock feeding, however, is to maintain soil fertility, farms which rely on live stock for the main source of their income will tend to become breeding centers for purebred animals: to be distributed through the surrounding country for breeding purposes on those farms on which only a limited amount of live stock is kept. The production of purebred animals is a highly specialized business, and only the most skilled animal husbandmen can make a success of it.

The fifth function which Mr. Rommel ascribes to live stock on the farm is not so directly connected with problems of income but it is nevertheless of vital importance. Experience has shown that nothing tends more strongly to create and maintain an interest in farm life among boys and girls than the care of animals. It is essential to the continued prosperity of this country that young people should be encouraged to make farming their vocation in life. Those who have devoted themselves to this work have found that among their most effective aids are the poultry, calf and pig clubs.

To the grown farmer the keeping of live stock is indirectly of value because its successful production requires the adoption of systematic, business-like and sanitary methods. No kind of farming, says the author, calls for more business sense than live stock farming.

That the neglect of live stock results in increasing the cost of living on the farm and in lowering the standard of that living is a fact well known to all agricultural authorities. For example, the annual meat bill of farmers for some states is enormous. The meat purchases are made largely on credit, and the proceeds of the year's crop are mostly consumed in meeting debts incurred during its production. This practice is obviously antagonistic to thrift and proper prosperity.

ARE PRICES HIGH?

Collin Campbell, Director Editorial Bureau, Portland Cement Association

Everybody should buy a Liberty bond.

Was there ever a more favorable time to build a silo, to buy a tractor, to build permanent highways?

Now is the time to exchange your farm produce for these necessities.

By doing this, capital will be created and placed in circulation. Prosperity will be stimulated, labor kept employed at good wages. The dollar will be kept rolling and more of our citizens enabled to perform their patriotic duty to BUY LIBERTY BONDS.

Let us keep on making, selling, transporting and building.

At prices of a year ago, it would have taken 50 bushels of wheat to buy a Liberty bond; today, one can be bought for 25 bushels.

Last year, a farmer could build a silo for the price of 800 bushels of corn; today he can build the same one for the price of 400 bushels.

Last year it cost a community the price of 16,000 bushels of wheat to build a mile of permanent highway; today a mile can be built for 8,000 bushels.

ELIMINATION OF WASTE A PATRIOTIC DUTY

Collin Campbell, Director Editorial Bureau, Portland Cement Association

Stopping waste will at once place this country on a basis of war time economy. That act alone would go far towards paying all war costs without interfering in the least with customary expenditures of the people. It is the logical thing to do and if done business will go on as usual.

Production is important. It is an urgent problem, and yet it is no more urgent than the problem of conserving that production in a way that will give to the people the fullest measure of use. Who will say that fire loss is necessary? Who will say that it cannot be prevented? When products on the farm are needlessly destroyed by fire through neglect to construct fireproof buildings, all expenditure in both time and money towards greater production has been destroyed. Stopping this stupendous fire waste is a matter toward which efforts should now be directed. Although fire is always calamitous, in war times it is even more so, for the losses sustained can be ill-borne and the burdens thereby developed are added to the country's war responsibilities.

Barns, elevators, warehouses, canning factories, cereal mills and other places where the raw products are kept until turned into food for ourselves and our allies should be so constructed as to insure the greatest degrees of safety possible. It is just as patriotic to exercise care in the sound construction of these buildings as it is to make our acres produce greater crops.

Waste may be eliminated in other ways. The man who owns 80 acres of land and permits 20 of it to remain idle because of poor drainage is wasting. Drainage would very soon put that 20 acres in crop producing condition and so increase the production

of soil that the cost of the drainage system would soon be paid for by the products of the soil, ultimately placing the 20 acres in a condition to add to the world's supply of food each season. Better drainage will lessen land waste and is therefore a patriotic duty.

Still another way of eliminating waste is by getting a greater amount of food value out of the soil for livestock. The building of a silo on every farm will make one acre of cornfeed twice as many cattle and keep them in better condition. The saving from this source alone would amount to millions of dollars annually. If you have no silo, build one; if you have one, build two.

The old-time fence strip is also a source of waste that should be taken into account now when every square foot should be devoted to crop production. Fence strips that have been neglected and allowed to grow weeds and patches that have been overgrown with brush should be cultivated this year. Good fences, and fences on which the expensive repairs are eliminated by good construction at the start, will add their share towards greater crop production.

It is the patriotic duty of every American, farmer or townsman, to take this matter straight home to himself and see where he can stop waste on his property. Putting time and money into buildings that are easily destroyed by fire, or buildings that soon decay, buildings that fail to properly protect grain, is a source of waste which undoubtedly can be stopped by better construction; and better construction is a war-time economy which will add to instead of hinder business.

INCREASED SUGAR BEET ACREAGE IMPORTANT

In view of the sugar situation, both domestic and foreign, it is advisable to increase the beet sugar output in the United States this year as far as the seed supply and the farm and factory conditions will permit. The indications are that in many portions of the area devoted to sugar beets in this country the acreage this year will exceed that of any previous year and will be in many cases limited only by the amount of seed now available. In other localities, it is understood that there is considerable beet seed which is being held in reserve for next year's planting in accordance with the usual practice. Under the existing conditions in this country and Europe, it may be advisable, says the United States Department of Agriculture, to utilize at least a portion of this reserve seed in those localities in which the farming and factory conditions will permit the handling of a larger acreage of beets than has at present been contracted for.

Sugar, an important food in time of peace, is doubly so in time of war, both because of the energy contained in a pound of sugar as compared with a pound of other foods and because the conduct of modern warfare has developed many additional uses for sugar. Therefore the sugar com-

panies and farmers of this country would be performing a patriotic duty by increasing the sugar output so far as practicable this season.

Undoubtedly considerable increase in sugar beet acreage could be brought about in some localities without interfering with the production of other crops. In the sugar beet growing states, except California (where the crop is already planted and growing), many farmers who have contracted to grow beets can undoubtedly increase their acreage somewhat. Many farmers in the sugar beet areas who have not yet contracted to grow sugar beets could undoubtedly plant a small acreage, thereby still further increasing the sugar production. Owing to the fact that sugar beets can be produced to advantage for sugar making purposes only in those areas where sugar mills are located, the areas in which they can be grown for sugar production are limited as compared with the larger areas that are or may be devoted to the production of other foods.

The sugar beet by-products, tops and pulp, are of high value for stock feeding purposes. Arrangements should be made, therefore, to utilize the sugar beet by-products as an aid in producing an extra supply of meat and dairy products.

NEWS NOTES FROM IRRIGATION PROJECTS OF THE COUNTRY

CALIFORNIA

More than 10,000 people participated in the dedication of the Woodward dam of the South San Joaquin irrigation district, twenty-six miles southeast of Stockton on May 12. The cost of this structure was \$600,000.

An offer of free water from the city for irrigation purposes, with the understanding that the crops raised for personal and not commercial use has been made to the people of Sacramento by the Commissioner of public works.

The newly organized Home Development Company of Auburn, Placer county, has filed an application with the State Water Commission to appropriate twenty thousand feet of the waters of Painter Creek and Buckhorn Creek in Lassen County for the irrigation of 9,055 acres in that vicinity, where the company plans the establishment of a colony of small ranchers. The estimated cost of the project is given as \$71,000.

The Empire Water Company of Los Angeles has served notice on the ranchers near Stratford that it will appear before the railroad commission and ask to have its contract set aside and increase the rate.

National guards have been stationed around the head works of the Modesto irrigation district and the Tuolumne river to prevent any attempts to damage the irrigation system at this critical crop period.

Twelve thousand acres of rice land near Colussa have recently been sold to a San Francisco syndicate.

Twelve carloads of mules and equipment recently arrived at Anderson to be used in excavation on the Anderson-Cottonwood irrigation district.

Charles W. Landis of San Francisco has filed an application with the State Water Commission asking for permission to appropriate 3,000 cubic feet per second of the water on the Mokelumne river to irrigate 150,000 acres. A reservoir with storage capacity of 250,000 acre feet will be located on the Rancho Arroyo Seco.

OREGON

The Squaw Creek Reservoir Company of Redmond has made application to the Public Service Commission of Oregon for authority to increase its rates for irrigation water.

Five hundred owners of lands under the Central Oregon Irrigation Project will be active in support of the formation of the proposed irrigation district now being planned under the

direction of a prominent Portland attorney. This move affects approximately 45,000 acres.

Advice has been received by the State Desert Land Board from Col. Wood of Portland that should the Portland Irrigation Company win in the courts in its litigation over the waters of the Chewaycan river, it will complete what is known as the Paisley Project.

Portland may become a manufacturing point for the Layne & Bowler pumps according to statements made to the Oregonian by Mr. Layne of that firm.

Irrigation projects in Oregon are public service corporations and are subject to the jurisdiction of the public service commission as announced from the attorney general's office.

WASHINGTON

In response to the demands from Washington that every possible acre on the various irrigation projects be made to produce a maximum crop for the next two years, a movement has been inaugurated, now state wide in its scope, for the immediate completion of the Wapato project. The land comprises approximately 150,000 acres and occupies the irrigable section of the Yakima Indian reservation.

The final report of the consulting board on the Horse Heaven irrigation district has recently been submitted to the board of directors at the headquarters in Prosser, Washington.

The project as estimated will furnish water for 215,000 acres without storage at a cost of \$66 an acre. In order to provide for interest during construction and discount on the bonds, a bond issue of \$18,250,000 is recommended.

There is no question about abundance of water for irrigation for this season in the Yakima country as it is stated that there is at the present time ten feet of snow at Lake Keechelus which forest service hydrographers say is equal to forty-six inches of water.

UTAH

pany has made application to the state engineer of Utah to have a field survey made of the Mammoth reservoir on the Price River in order that the dam may be raised from 67 to 135 feet in height.

The North Willow Irrigation Company of Grantsville has filed with the state engineer application for ten second feet of water to be taken from the sources of supply of North Wil-

low and Davenport creeks in Tooele County by a water developing tunnel. The water, which will be used to irrigate 2,000 acres of land, will be conveyed to the land by a sixteen-inch pipe 29,000 feet in length.

Hundreds of thousands of acres of school lands within the national forest area of Utah, title to which has been in question between the state and the government for years, will be made available to the state for disposal for the benefit of school funds as a result of a decision by the supreme court of the United States.

There are 422,000 acres of such land in Utah and Senator William H. King has requested the general land office to expedite action upon the Utah lists, that the state may come into full possession of the lands and derive all the benefits arising from such possession.

The decision by the supreme court of the United States was in the case of the state of California, plaintiff in error, against the Deseret Water Oil & Irrigation Company, reversing a prior decision of the Supreme Court of California. This decision has formed the basis of action by the department of the interior which will clear titles to these lands, which in various states have been the subject of different court rulings and decisions.

Frank Miles of Richfield has filed application with the state engineer for fifty second feet of water to be taken from Paria, or Pareah, river in Kane county for the irrigation of 5,760 acres of land. The Farm Creek Irrigation Company of Tabiona has filed application for five second feet of water from the Duchesne river to be used for irrigation purposes.

MONTANA

A municipal garden of not less than fifty acres is planned by Mayor A. J. Fousek of Great Falls, who will specialize in beans, onions and potatoes.

Farmers with land along the Fort Peck irrigation project will plant alfalfa on an extensive scale this year.

The rate for irrigation water for the Flathead irrigation district has been changed by the federal reclamation service. Rates announced will be in force during 1917.

A flat charge of fifty cents per acre will be made, instead of a minimum charge per acre irrigated. In addition to this the requirements exact a minimum of \$5 per farm unit.

Uncle Sam will take a hand in breaking up the soil on the Sun river irrigation project, looking to increased acreage and a bigger crop production. As a part of this work about to begin, a gasoline tractor of the 25-50

type has been purchased and will be kept going turning sod as long as its services are required.

A contract was awarded May 16 to Rolla Barnes, Malta, for the excavation and earth lining on the Nelson South canal, Milk river irrigation project. Contract price was \$8,750.

A big year is predicted for the farmers of the Bitter Root valley. The largest acreage of grain and vegetables in the history of this section has been planted and with a favorable season the yield will be immense.

IDAHO

The Minidoka irrigation district and the local office of the United States department of agriculture have established bulletin boards at their respective offices with a view to assisting the farmers of the project in their effort to comply with the request of military and state authorities that all available land be utilized. The idea is to list the wants of the farmers of this section along lines of help wanted, employment sought, land for sale and the names of prospective purchasers.

Surplus waters in the reservoirs on Carey Act Project in the state will be distributed under the direction of the state engineer this season to people who wish to raise crops on unentered lands, it was announced at a meeting of the state land board of Idaho recently.

The taking of surplus waters for irrigation purposes is termed a war measure, and is being inaugurated with a view to encouraging the cultivation of all irrigable lands.

The plan to appropriate waters stored by the Carey Act companies was outlined by the governor to the executive committee of the Idaho Irrigation Company of Richfield, when the members appeared before the land board Wednesday for the purpose of getting acquainted. The members of the executive committee are men from the East and Middle West. They came to Idaho to visit their project.

According to the governor, the land board expects to control the distribution of water in irrigation districts on Carey Act projects and from private sources. He announced that the state engineer had been authorized to conserve the water and make it do a larger duty than in normal years.

The government has moved to take charge of the King Hill project. F. E. Weymouth, chief of construction for the reclamation service, headquarters, Denver, Saturday notified Governor Alexander that J. H. Miner has been selected as project manager and will reach Idaho at an early date. A total of \$5,000 has been made available for the present fiscal year to start the necessary surveys and make such other investigations as are necessary on the project.

Some time ago the state purchased

the King Hill project under the hammer after private capital failed to complete it. Since then the state has paid the maintenance and had a manager in charge. The matter of the government taking over the Carey Act segregation to relieve the state was taken up with the Interior Department with the result that the plan was approved by Secretary Lane and an appropriation of \$200,000 for that purpose subsequently passed. The reclamation service has been placed in charge. This is the first Carey Act project the department has taken over. Saturday the governor received the following self-explanatory letter:

"Hon. M. Alexander, Boise, Idaho. My Dear Governor—Referring to the matter of the reclamation service taking over the King Hill project in the event the appropriation pending in Congress is approved and in the further event that a suitable contract can be entered into with the state, this is to advise that the director has allotted from secondary project funds a total of \$5,000 for this fiscal year, which is immediately available to start necessary surveys and other investigations in order to get ready for construction work at the earliest practicable date.

"Mr. J. H. Miner, at present project manager of the Grand Valley reclamation project in western Colorado, has been selected to have charge of that work as project manager, and I have asked him, when he reaches Idaho, which will be at an early date, to call upon you in connection with this work.

"I understand that the legal department of the Reclamation Service is giving consideration to the legal phases of the situation.

"Very truly yours,

"F. E. WEYMOUTH,
"Chief of Construction."

MISCELLANEOUS

Gen. H. F. Robinson, superintendent of the Indian irrigation service, yesterday completed the plat for a new townsite opposite the Santa Clara pueblo, New Mexico. The plan will be sent to Washington, and if approved by the department the new town will be established. It will be separated from the old pueblo by the Santa Clara creek, which furnishes water for irrigation at the pueblo.

The townsite was requested by the young men of the tribe because of dissatisfaction, and because they fear another epidemic of scarlet fever, such as visited the pueblo last year.

An irrigation dam in New South Wales which will impound about 32,380,000,000 cubic feet of water, backed up in a lake forty miles long, will cost \$3,680,000.

The irrigation of 16,000 acres of land is contemplated by the Santa Helena Improvement Company, San Benito, Tex., the estimated cost being \$500,000.

The Truckee river at Reno, Nev., has begun to feel the effects of

spring. It is muddy and running high, and all the water in it with the exception of twenty-three second feet is coming from melting snow below the 6,500-foot level in the mountains.

The fact that this snow is melting now does not indicate that there will be a shortage of water for irrigation purposes in the Truckee valley during the coming summer. There is plenty of water in lake, although at the present time the level is about six inches below normal for this time of the year.

The irrigation department of Siam has taken over the works of a large private irrigation company at Klong Rangsit, in order to extend the irrigation not only to the entire district covered by the activities of the company, but also farther north. The total project is to cost \$50,000,000. Immediate improvements contemplated embrace the expenditure of about \$4,250,000.

In connection with the Huntley project, Montana, certain supplemental construction in the canal system of the first unit is desirable which will increase the construction charge in the sum of \$4 per irrigable acre, and also certain supplemental construction is desirable for drains for the protection and relief of lands under the same unit, which will increase the construction charge in the sum of \$11 per irrigable acre. The secretary of the interior has directed, therefore, that all lands within the first unit for which acceptances of the reclamation extension act have been duly filed, shall be charged with the cost of the above described works a total of \$15 per irrigable acre. These payments will be made in easy instalments after the payment of the last of the regular instalments payable under sections 1 and 2 of the reclamation extension act.

The directors of the Wenatchee reclamation district have sold \$160,000 of district bonds to the Spokane & Eastern Trust Company of Spokane, through Herbert Witherspoon, vice-president of the company. The price was 95 cents, said to be the highest price ever paid in the West for such a large block of irrigation district bonds. The court receivership is to be ended as soon as the court formalities can be provided for. A great deal of permanent work has been done on the canal this winter.

Another survey of the ditch lines and power site of the Louis Lake irrigation and power project near Lander, Wyo., is under way. The water is to be stored in Louis Lake at the head of the Little Popo Angie, and taken as wanted from the Little Popo Angie lower down the stream.

E. S. Gooch and associates are interested in the construction of an irrigation system near Lawton, Okla., to cost about \$100,000.

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The Secretary of the Interior has executed contract with the State of South Dakota providing for the expenditure of \$5,000 by each contracting party for the purpose of cooperative investigation of what is known as the Angostura project in that state.

The project is located in Canter, Fall River, and Washington counties, and surveys will be made, particularly in the basin of Cheyenne river, in order to ascertain the feasibility of irrigation projects to outline their limits, character and cost of development; also to determine the ways and means whereby the public waters, natural lakes, if any, reservoir sites, state and public lands, and other resources may be used, reserved or disposed of in connection with such irrigation projects to the highest advantage; also to determine what power may be developed as an incident to the construction of such irrigation projects, and the value and possible uses thereof.

Under authority of the Secretary of the Interior the Reclamation Service has awarded contract to the R. Hardisty Manufacturing Company of Denver, Colo., for furnishing 76 small lateral turn out gates for the Shoshone irrigation project, Wyoming.

The contract price is \$5,543.19.

Under authority of the Secretary of the Interior the Reclamation Service has awarded contract to Parsons Company of Newton, Iowa, to furnish two drag line excavators, one for the Truckee Carson irrigation project, Nevada, and one for the Shoshone irrigation project, Wyoming.

The contract price is \$14,474.

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The Office of Public Roads of the Department of Agriculture has published a bulletin on "Repair and Maintenance of Highways." This bulletin does not treat the subject of road building, but takes up the repair and care of roads after they are built. All classes of roads, from the natural earth road to the macadam roads with bituminous surfacing, have received attention. The action of automobiles on road surfaces is explained. The systems of road management in Massachusetts, New York, England, and France are given, with tables of costs.

The writer concludes that on account of the use of heavier vehicles and motor trucks the tendency of road building is toward a heavier and more substantial foundation and a consequent reduction of the cost of maintenance.

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The Executive Committee of the National Federation of Water Users' Association has taken action whereby THE IRRIGATION AGE is created the official organ of this vast organization, representing 1,000,000 persons on the government irrigation projects.

Study New Payment Suggestion

The more one considers the suggestion of the Uncompahgre Water Users' Association that one dollar per acre per annum should be the basis on which future settlement should be made for water on Federal project tracts, payments to be made under strict and precise supervision of the Department of the Interior, the more fully is the writer convinced that this plan can be worked out to advantage to the Government as well as the settlers.

The 90 million dollar investment has caused no end of trouble to the Department of the Interior and has imposed burdens on settlers who were in no condition to bear them.

Leaving out all questions of mistakes which were made in making and publishing cost estimates, is it not better for all concerned to come to some sort of an understanding and in that way eliminate the turmoil incident to affairs that are admittedly in a bad condition.

It is the opinion of the IRRIGATION AGE that Secretary Lane would welcome suggestions along this line and it should be remembered that such recommendations would have a better effect if presented simultaneously by all the projects.

The IRRIGATION AGE would like to hear from the officers of each water users' association concerning this suggestion so that some plan may be laid out to bring all of the association heads together for conference.

One Dollar Per Acre A Year

Mr. F. D. Catlin, attorney for the Uncompahgre Water Users Association, suggests as shown in a letter to a Colorado congressman published in this issue, that the settlers unite in an effort to induce the Department of the Interior to accept \$1.00 per acre on construction cost, which sum added to the operation and maintenance fee would, in his opinion, be about all the settlers on each project can comfortably pay.

This would necessitate an amendment to the Reclamation Act. It is his opinion that this will solve all difficulties, as it is pointed out that by reason of the fact of the settlers taking over the projects at an early date one-half the cost of operation and maintenance can be saved. In other words the settlers can, in Mr. Catlin's judgment, operate the projects for one-half what it costs at present. "\$1.00 per acre per annum toward construction charges" should, in Mr. Catlin's opinion, be the slogan for all water users unless some one can devise and make public a better plan.

"This would insure the success of all projects, will inspire confidence," says Mr. Catlin, "will renew enthusiasm; will remove all apprehension and worry as to ability to pay; will permit all the projects to adopt the irrigation district plan and thus bring each settler where he may take advantage of the Federal Farm Loan Act.

Mr. Catlin further states that the Government

has plenty of time; it has already invested 90 millions on a 40 million estimate, and moreover, unless some such solution is acted on the Government will have lost a great part of the fund, besides bringing untold distress on the people.

Mr. Catlin is of the opinion that if all water users' associations get together, renew and thoroughly organize the National Federation of Water Users and bring the members together annually at some central point like Salt Lake City (there are 90,000 water users under the Federal projects) great results would follow.

This latter plan of an annual meeting has been suggested many times by the IRRIGATION AGE. This journal has been made the official organ of the National Federation of Water Users Association and is ready at all times to help this movement along.

Salt Lake City is the most central point for all the 26 projects as well as all private and Carey Act development, and the writer will visit that city in July with a view to stir up interest there and at the same time learn what the citizens will offer in the way of accommodations and entertainment in case it is finally decided to hold annual meetings there.

It was suggested at one time that a monument to Irrigation (in the form of a temple or auditorium) be erected in Salt Lake City, and it is our opinion that a bill was introduced in Congress asking for \$250,000 to be used for that purpose.

A building of this character would fit in well with the plans above outlined and additional information will be obtained at the time of the writer's visit so that more may be told about it in the IRRIGATION AGE for August.

Uncompahgre Project Wins Concessions The Water Users of the Uncompahgre Project, Colorado, sent a delegation to confer with Secretary Lane in May, and a prompt and complete hearing was granted. All matters under dispute were gone over and the members of the delegation are enthusiastic about the reception given them by the Secretary of the Interior.

One concession granted is that the project is to be operated for five years from December 1, 1917, by the water users, the latter to pay during that time the actual cost of operation and maintenance. The payment of the assessments for construction charges has been postponed five years. This will give the settlers that much longer to get on their feet and should make it much easier to meet payments from December, 1922.

The matter of taking over the maintenance and operation of the projects for a period of five years

is no small undertaking, but those who are acquainted with the men that are actively in charge will have no fear of results. In the opinion of the editor of the IRRIGATION AGE the settlers on the Uncompahgre project owe much of their success to the untiring efforts of Mr. F. D. Catlin, an attorney at Montrose.

Secretary of the Interior. Lane

The time has arrived when an on-looker who may have expressed varying opinions of Secretary Lane and his policy toward the settlers on reclamation projects may be permitted to give an opinion far from unfavorable concerning him.

It was feared during the earlier years of occupancy of this exalted office that the Secretary of the Interior was being swayed "as moves a swing" by breezes emanating from the flummery of different department heads in the reclamation service.

This was more noticeable on account of his splendid utterances and activities in connection with work unassociated with reclamation.

It is now safe to say that no Secretary of the Interior in the past forty years, which is about the period of range of the writer's recollection, has been more conspicuous for broadness of vision on public questions than has Secretary Lane.

This statement refers to that part of his service other than the reclamation of lands by irrigation.

Judging from recent information the Secretary has at last discovered the inner facts about the settlers and is determined to give them a fair run for their money.

In looking backward over the field it now becomes evident that he has been gradually feeling his way and has come to the conclusion that the settlers rather than the officials of the reclamation service are the base on which the success of this great work must rest.

This is amply proven by his decision after hearing the settlers' side of the Uncompahgre project muddle.

The writer found occasion to say to a prominent official of the service some weeks prior to the time of the visit of the Uncompahgre Settlers' Committee to Washington, that a milder attitude toward the settler would accomplish much more than any attempt at bulldozing, and the advice was supplemented by the statement that it was the height of folly to tap a hornet's nest with a walking stick without definite knowledge that at the time of tapping the thermometer registered below zero.

On the assumption that the Secretary's stand on the Uncompahgre matter is an indication of his future good intentions, the settlers have much to be thankful for.

A WATER USERS' ASSOCIATION AS A PRACTICAL FORM OF ORGANIZATION FOR THE FEDERAL WATER USERS¹

O. E. Farnham, Secretary Belle Fourche Valley Water Users' Association

At this particular time there is a great deal of stress being placed on the advantages of the Irrigation District plans of organization for the Federal Waterusers over the present Water Users' Associations.

It matters not whether the organization be termed an Irrigation District or a Water Users' Association if the form of organization is practical and its affairs are controlled by those who have to pay the bills. A water users' association may be formed along practical lines and accomplish substantially the same results as the Irrigation District plan. Especially is this true of the projects which have passed through the promotion period.

The writer is more familiar with the form of organization adopted by the Belle Fourche Valley Water Users' Association than any other of the Federal Associations, and will use it as an illustration.

The Belle Fourche Valley Water Users' Association holds its charter by virtue of the Laws of the State of South Dakota, was incorporated in 1904, and its purposes and powers as set out in its articles of incorporation are as follows:

Article II. Section 1. The purposes for which this Association is organized and the general nature of the business to be transacted are:

To provide for, distribute, and furnish to the lands of the shareholders of the Association, as herein provided, an adequate supply of water for the irrigation thereof; to divert, store, develop, pump, carry and distribute water for irrigation and all other beneficial uses, deriving the same from all available sources of supply; to construct, purchase, lease, condemn, or acquire in any manner whatsoever, and own, use, sell, transfer, convey, control, maintain, and operate irrigation works, structures, telephone systems, electric or other power plants, and property both real and personal of every kind whatsoever, necessary or appropriate for the accomplishment of any of the purposes aforesaid; to have and exercise all the powers and do all and everything necessary or appropriate for the accomplishment of any one or more of the said purposes or anything incident hereto.

Section 2. This Association shall have the power to enter into any contract or other arrangement with the proper representative of the United States, or any other person, for the accomplishment of any of the aforesaid purposes, by means of the construction, acquisition or control of appropriate works or structures, or in any other manner whatsoever.

Section 3. It shall have the power to enter into

any agreement with the proper representative of the United States with reference to the collection and payment of any and all charges made under the Federal statutes for the works providing water for the lands of its shareholders.

Section 4. It shall have power to comply with the provisions of any Federal Statutes applicable to the work done by the United States in connection with such system of water supply, and any rules and regulations established thereunder.

Section 5. This Association shall have power to act as trustee for the sale, disposal and transfer of lands in order to facilitate the disposal of such lands to persons qualified to perfect rights for the use of water under the Federal Statutes applicable thereto and the rules and regulations established thereunder.

It was found that the private corporation laws of the state were not practical in every respect for an organization of this kind; but no difficulty was experienced in procuring the needed legislation.

The organization is under the control at all times of the majority vote of its shareholders, and each shareholder has a voice in all elections according to the extent of his holdings, 160 acres being the maximum limit of irrigable acreage any one shareholder may own, and he is entitled to a share of stock for each irrigable acre. No proxies are recognized, and no one but the owner can vote his stock. The project is divided into nine directors' district, and each district elects its own director. In order to qualify as a director one must, in addition to being a shareholder, reside upon land within the district from which he is elected.

The elections are kept entirely free from politics, and nothing but association affairs enter into them. The form of organization is most democratic and responsive to those who are directly interested and must bear its burdens.

Under state law the association has authority to levy assessments, which are by law and contract created a lien against the land and water-right appurtenant thereto of the shareholder. The by-laws of the association are adequate for enforcing the payment of assessments, and the lands and water rights may be sold practically in the same manner as the state conducts delinquent tax sales.

In the Belle Fourche project the association under its contract with the Department of the Interior is co-operating with the reclamation service, and the public lands within the project are made to bear their share of the cost. The state lands

are subjected to the project obligations and enjoy its advantages by virtue of state law, and these lands can only be sold to qualified water right applicants in farm units of limited size.

Under our form of organization canal divisions may be organized on petition by majority of acreage affected, and local improvements in the irrigation system may be carried on by majority vote of the acreage directly interested and which bears the expense.

A great deal has been said concerning the lien which the association and the United States Government possess as security for the payment of construction and operation and maintenance charges, and it has been decided, I understand, by the Federal Land Board that this lien precludes the extending of credit by the Federal Land Banks to these lands. The Irrigation District plan would not in any way remedy this, unless the Department of the Interior by authority of new legislation should surrender or waive its lien which has been credited by the individual water right applications in favor of the United States, and which lien may be enforced either directly by the Government or through the medium of the Water Users' Associations. I am of the opinion that the association as a private corporation by its executive board may waive its lien to the extent of the loan in favor of the Land Bank whenever it is satisfactorily shown that as a sufficient consideration therefor the moneys borrowed by the water user is to be used in development work on the land and thus increase the value of the security. Many loans are being made on the Belle Fourche project by private capital at the present time and have been made for the past four years, some of them as high as \$3,000 and \$4,000 on a farm unit, in the face of the lien held by the Government and Water Users' Association. As to affording an opportunity for the shareholders of these associations to take advantage of the Federal Farm Loan Act, it seems to me legislation is only needed permitting the Department of the Interior to waive its lien to the extent of the loans made in favor of the Land Bank. This will be necessary whether the local organization is a district or an association.

There is one instance, however, and only one, that occurs to me where the Water Users' Association, under its present form of organization, might be handicapped; and this might be remedied by amending its articles of incorporation under proper legislative authority. It cannot enforce indifferent owners to obligate their lands to the cost of construction and operation of the project. This, however, does not particularly interest the Federal projects now in operation or under construction.

The Irrigation District plan does not appeal to me in a number of particulars. The control of the project to some extent at least is in the hands

of county officers, instead of being managed by those who are directly interested and must bear the burdens of its development. The policies of the district would in a measure be dependent on political conditions in the county generally. In other words, it would not give the landowners and water users directly concerned that measure of representation in the management of their own affairs and according to their respective investments to which their vital interests are necessarily entitled.

As an argument in favor of the district plan, it has been stated that the nature of the work or enterprise is public. It is no more so than the building or operating of a railroad or of any large manufacturing establishment which employs many men of the community. Yet the affairs of these concerns are controlled by those who finance, build and operate them.

Even in the promotion stage of a project, in the semi-arid regions, I am inclined to think that the irrigation district plan would be a source of much contention and costly litigation. Especially where dry-land farming is carried on quite extensively in the immediate vicinity of the proposed project. The voluntary signing up of lands in the proposed project would lend greater assurance for the success of the project. And there are plenty of feasible projects of this kind waiting for the necessary capital to build them. It doesn't seem hardly fair nor the part of good business judgment to overlook such communities and expend the public moneys to build expensive works where perhaps only a bare majority of the electors have expressed a desire for irrigation. There is always a great clamor in most communities for the expenditure of public funds, and it is comparatively easy to vote in a project, but it is another question to procure contracts directly from the landowners, and the proposition must appeal to them from a business standpoint, and it should be considered as a business proposition. At least, so long as there are projects of this character available for development.

The whole irrigation district scheme savors too strongly of politics, and is not founded on sound business principles. And an irrigation project not so founded is doomed from the beginning. Do not misunderstand me. It may pay out in time, but the water user on the land must be prepared to endure many hardships and sacrifices. Irrigation is a business of its own and should be kept free from politics. Under the district plan of voting, the owner of a small parcel of land has the same voice in elections as the owner of 160 acres. This is unjust and necessarily results in taxation without representation.

From a water users' viewpoint I have been unable as yet to see any advantage in the Irrigation District plan over the present associations.

AN INTERESTING DRAINAGE DEVICE

Storm Water in California Cities Drained Into Irrigation Ditches and Back Flow Prevented
by New Automatic Gate

The necessity for some sort of apparatus which would automatically permit the drainage of tide lands, through levees, without leaving an opening through which a rising tide might again flood the areas to be drained, has brought about within the last few years the perfection of a cast iron automatic drainage gate. Because of the exceptional efficiency of this gate, which is so designed that it is sensitive to as small a variation in head as one-eighth of an inch, it sprang into instant popularity throughout the so-called "Island Country" of the Sacramento and San Joaquin valleys in California, as well as in



Automatic Drainage Gate Attached to Corrugated "Armco" Iron Pipe.

other sections of the state which are affected by flood conditions, and great numbers of these structures have been installed throughout California during the last three or four years to take care of these conditions.

Even the manufacturers saw no further need for the gates than its use in tide lands until they began to be called for in unexpected localities, and investigations of their usefulness in these places brought out the value of these gates in draining county roads and city streets. Irrigation ditches are so numerous in California that a great many of them run inside the limits of incorporated cities, as well as cross practically all country roads in the irrigating sections. Where practicable in cities, it has become customary to drain storm waters from gutters into these irrigation ditches. Most of the storm water comes at times when the ditches are otherwise free from water and no inconvenience or damage has been occasioned by draining these storm waters into the ditches. Great inconvenience has been experienced in some cases, however, when the irrigating waters in the ditches, coming during the summer months, have backed up into the streets through the openings out into the ditch walls to permit the drainage of the storm waters.

This type of automatic drainage gate has been found to completely solve this problem. The gate is attached to the culvert—usually a section of Armco iron corrugated pipe—which goes through

the ditch bank, the gate being on the outlet end of the pipe and inside of the ditch as shown in the accompanying illustrations. When the storm water comes, the water itself, pressing against the gate, opens it and permits of complete drainage into the ditch. Irrigating waters, coming along later, simply serve to keep the gate entirely closed as they press back against the outside surface of the gate, and no ditch water is permitted to force its way back into the street. The condition on county roads is very similar, except that in a great many cases little effort has heretofore been made to drain storm waters which came down the roads and were stopped by ditchbanks, where they usually created large ponds, backed up against the levees, there remaining until the summer sun dried them up. The photograph above shows the installation of one of these gates, 24 inches in diameter, on a road leading out of Riverbank toward Oakdale, Stanislaus County, California, where storm water had, until this device was put in operation, been annually a source of annoyance. The water comes down this road in large quantities during the stormy season of the year and had been in the habit of accumulating against the bank on the outside of the ditch, where it made a great puddle, which was not only injurious to the road itself, as well as inconvenient and troublesome to traffic, but was dangerous to the ditchbank which it had a tendency to soften. Since the gate was installed all this has been done away with completely. When the storm water comes it drains



8-in. Calco Auto-Drainage Gate in Operation Discharging Water from Gutter Into Irrigation Canal in City of Fresno, Calif.

through the gate directly into the ditch and is carried away. When the ditch water is running, none of it gets back onto the road. The photograph shows a small amount of irrigation water running into the ditch and it can be clearly seen how the gate shuts off the possibility of any of this water finding its way back into the road. At the same time the ditchbank is protected from softening caused by water standing against it from the outside, or from being weakened by constantly cutting it open to permit drainage and then refilling.

AN INTERESTING LETTER

Addressed to a Member of Congress by Mr. F. D. Catlin, a Prominent Attorney of Montrose, Colo., Concerning Recent Hearings Before the House Committee on Irrigated Lands

Montrose, Colo., June 7, 1917.

Hon.

Washington, D. C.

Dear Mr.—I have read with interest the several parts of the reports of hearings before the committee on irrigation of arid lands, and have just received and finished reading Part 6, which contains certain statements that seem to me reveal a misapprehension on the part of several of the parties to this hearing.

As you know, we of the Uncompahgre Project, are vitally interested in the questions before your committee. I have resided here for over 32 years, and have been personally connected with the loaning of several millions of dollars on farm mortgage securities, and we have for clients, nearly a million dollars now in force, some of which are on lands and water rights within the Uncompahgre Project. We also own lands under the project, and we know, or ought to know, the exact conditions here, both from the owner's standpoint and the standpoint of the money loaners. And we are also deeply interested in the success of the Farm Land Bank loans, as we believe that they will bring a greater prosperity to our country, both directly and indirectly. As loan agents, we are not afraid of the competition of the government, because whenever the government will loan at 6 per cent or less our clients will also do the same, and as stated by Mr. Norris in Part 6, there has been a reduction of at least 1 per cent in interest rates here since the passage of the Farm Loan Act in anticipation of the effect of the government loans, although none have yet been made here or near here, and it is still questionable whether any will be made under the project or not. But the community has received this benefit of a reduction of from an average 8 per cent interest to an average 7 per cent interest. And when it reaches 6 or 5 per cent, as I have no doubt it will, we expect our superior facilities for the quick handling of loans and details of payments and general accommodation of the borrowing public, to still do our share of the business.

Therefore, we are anxious for your committee to successfully solve the question between yourselves and the Farm Land Board, so that our project settlers may receive such borrowing credit as they may be entitled to, and the lowest possible rates of interest. All of which will tend to a greater general prosperity.

I, therefore, want to call your attention to several features of Part 6 of the hearings wherever the views expressed do not seem to be clear, or the parties do not fully understand the real difficulties. In the letter of Mr. Norris, page 140, we are pleased with the statement:

"These reclamation projects were undertaken and carried out honestly and with the best of intentions, but it would seem as if in many cases there was a failure to consider the economic conditions that would confront settlers, and the government failed to give to many of these settlers the financial cautions or to extend to them the financial assistance that are generally extended by private individuals or corporations feeling a proper responsibility for the success of settlers whom they establish on colonization projects."

And again on page 138, Mr. Norris splendidly says:

"If a private corporation had treated a lot of people as the government has treated a lot of the settlers on the irrigated lands, that corporation would be under indictment today, all done with the best intentions, but the consequences have been most cruel."

I will try to confine my references, explanations and statements to conditions as they exist on the Uncompahgre Project. But I believe the same conditions practically are found on most of the projects.

The object of your inquiry, as I understand it, is how to permit settlers on irrigation projects to obtain the benefits of the Farm Loan Act. Messrs. Norris and Lobdell clearly state that the board will not accept second mortgages, and, therefore, the reclamation lien must be waived as to Farm Land Bank loans. I cannot imagine

it is really intended for the purpose of waiving the lien for the benefit of the Farm Land Bank as such, but to procure credit and assist the settlers; and it does seem to me that if a way can be found and an amendment devised that will accomplish the purpose, that it should be to waive the lien for all investors who will supply moneys for the same purposes stated in the Farm Land Bank law, at the same or a better rate of interest than is required by the Farm Land Bank. For it seems it does not need argument to say that when the Farm Land Bank has accomplished its purpose, and private investors are ready to loan at the same or a lower rate of interest, than the Farm Land Bank, that the Government will be willing to retire from the money loaning business; and it would not seem that it could be intended to favor the bank for the purpose of aiding it in competition, but only for the purpose of aiding it to aid settlers, and that any one else who will aid the settlers in an equal or greater degree should receive the same protection and inducement from your efforts.

While Mr. Norris on page 138 refers to money loaners as "sharks," after the common epithet applied thereto, had it not been for the assistance of the people who have been willing to loan, even at a high rate of interest and on this project 8 per cent has been the average rate on real estate, settlers would have suffered much more than they have, which has already been sufficiently grievous, and really with the failure of encouragement or co-operation from the reclamation people, and the hog-tied condition of the settlers as to their titles and ability to give security, the name more appropriate to be applied to those who have had the temerity to loan to them, even at high rates of interest, should be "another kind of fish with a round mouth and a strong suction."

Now although Mr. Norris implies on page 143, and Mr. Little emphatically states on page 139, that unless the amendment in question can be efficient, "that if that way of solving it, there is not any way of doing it at all," I feel sure there will be found a way, and equally sure that it will not be by the way of the amendment proposed. Mr. Norris repeatedly says that if the lien were by way of a contract or bonded indebtedness due from an irrigation district payable by annual assessments through the county taxing machinery, that under the ruling of the Farm Loan Board it would not be considered such a lien as to prevent accepting farm mortgages in such district as being first mortgages or first liens. But this, it seems to me, is not a well taken position, with all due regard to the opinion of Judge King, for the reason that by experience we know that an irrigation district or a county that is so heavily laden with bonded indebtedness as to make conditions unsatisfactory and prosperity to the settlers impossible is no place to invest money. And we do not believe that the Farm Land Board will be different than other investors in respect to this. We refer you to the irrigation districts of Delta County, Mesa County and Montezuma County in Colorado, which are nearest us, and therefore of which we have best information. No loan company or loan agency or private investor will consider a loan under these districts. And we are credibly informed that the same condition is everywhere. The nature of the indebtedness of an irrigation district is different from a bonded indebtedness of a school district. It is always greater in proportion, and the method of foreclosure is so arbitrary that investors have no desire to place funds where they can have the title sold out from under their mortgage without even foreclosure or a day in court. We find that 50 per cent or more of the assessments for interest and maintenance and operation in these districts is delinquent, and the property sold for taxes, and the title rapidly expiring by way of tax deeds. We don't expect the Farm Loan Bank will be less conservative than the loan companies, but if there is any difference that a greater care will be observed, as Mr. Norris repeatedly says, they will take no

chances of ruining the reputation of their bonds before the investing public. Our office has made some few loans under this project even since the lien was recorded, but we have continually and uniformly refused to make any loans under irrigation districts. It is not, we believe, a difference in the form of the indebtedness, or, as Mr. Hayden says on page 129, a hocus pocus distinction that should count or will count, but whether or not there be such indebtedness for which the land is liable in any form, be it irrigation district or otherwise, that would threaten the security, that will govern investors including Farm Loan Board. Indeed, I have in mind a school district in Colorado which by reason of the failure of certain mines so great a reduction has been made in the assessed valuation that the bonds for erecting a large school house needed when the mines were prosperous has now produced such a condition that by suit in mandamus the board is being required to levy from 30 to 50 mills special per annum to pay annually towards these defaulted bonds. It takes a period of about 10 years with these high assessments to pay out the indebtedness. We would not, nor would any careful investor, we believe, including the Farm Loan Board, make farm loans in such a district. It lacks but little, and it requires no stretch of imagination to conceive of a case where school bonds might be such a burden as to prevent loans. Therefore, in my opinion, it is clear that the distinction or criterion must be the burden, not the form of the indebtedness. And this brings us to the proposition that I wish to present to your consideration. It applies not only to the Uncompahgre Project, but nearly all, if not all, of the projects.

By reason of the under estimate of the costs, the government has its \$90,000,000 invested in projects that were estimated to cost only from one-third to one-half that amount. It is useless to discuss how or why this happened. It is not only true of government engineers, but all engineers we have met. It does not seem to be practical to obtain from an engineer's estimate reliable data for the cost of moving a cubic yard of earth a given distance. But it is true, as Mr. Norris states, that from a business and financial standpoint if an investor has made a loan on security that does not, and cannot pay out, that the investor must endeavor to find the most available common sense remedy. If there was ever a time that that financial common sense was necessary to a superlative degree it is now and here. Then assuming, which I believe to be true, that there is no desire or intention on the part of the settlers to repudiate; that there is a great desire on the part of the reclamation service, the Interior Department and Congress to keep the reclamation fund intact as far as possible, that it is practically impossible from a business standpoint, and it would be really useless and inefficient for the government to waive its lien to one department of the government in favor of another department of the government, and which would bring no relief to the settler who must in the end pay it all, and though temporary relief might be gained it would still leave all the problems unsolved. Is it not then clear and apparent that the real need is for an extension of time? On this project, and so far as I know, on all projects, the average land cannot pay more than one dollar per acre per annum on the cost charges, in addition to the annual cost of maintenance and operation. All of the settlers here, and so far as I know, throughout the projects, are willing to pay what they can. Therefore, if the government will amend the reclamation act so as to require only the payment of one dollar per acre per annum toward the construction charges, I believe you will have solved the entire difficulty. The settlers will maintain and operate their projects. Let them take them over at once. They can save probably 50 per cent of the cost of maintenance and operation under government control. There will ensue immediately a feeling of cheerfulness, hope and prosperity in place of the present conditions of depression, dissatisfaction and destitution; instead of such failures as the North Dakota Pumping Plant Project, the Garden City Project, the Hondo Project, which have been practically abandoned, according to the reports of the reclamation service, and are useless to the settlers and hundreds of thousands of dollars lost to the government and the Lower Yellowstone and the Butte Elephant Dam Project, where the conditions are such, I am reliably informed, that it is doubtful without immediate change of policy, whether the government will ever

be returned one dollar of their investment and the dozens of other projects where it will be impossible for them to repay the construction charges within the 20 years' period, as required by law. And the people by reason of the present policy and the law and the regulations are rapidly being discouraged and caused to give up their holdings, and all are laboring in fear and trembling. There will be an immediate solution of the difficulties and resurrection of all of the hopes and expectancies of the original ideals entertained and advocated on the passage of the Reclamation Act.

The only objection to the irrigation district with us, and we believe with many other projects, is that such a district is an automatic machine by which the people are asked and if they adopt it, will annually execute a large percentage of their fellow settlers through the tax office, and the selling of delinquent lands, and ousting of the non-paying settlers in no manner helps the situation, as the burden is placed over on those who do pay, thereby increasing them to such an extent that annually a new class of delinquents are placed on the list, until the entire project is wiped out by the impossibility of payment of unreasonable and impossible assessments.

The original act for payment in 10 years was made without due consideration. The 20 year act was adopted as a relief, and accepted as being because of inability to get a better period at that time. The "experts" who have done most of the figuring for the reclamation department have not been practical farmers, and do not know the rule recently announced in our association directors'



Close-Up View of 8-in. Calco Auto-Drainage Gate Discharging Storm Water From Gutter Into Irrigation Canal (P. 136).

meeting by the most successful farmer of the directory, who says: "I have found that in all farming you can first carefully and conservatively ascertain the probable income and divide it by two, and then carefully and liberally estimate the cost of production and marketing, and multiply that by two, and you will not be far from the actual results."

If such an extension amendment were passed there would be no objection on this project, nor any other, I believe, to immediately adopt the irrigation district plan, which will be an automatic self-working, inexpensive collection agency by which the cost charges will be collected and returned to the government. In case of any failures to pay the foreclosure will be by the arbitrary and inexpensive method of tax sale, with liberal period of redemption, and all contentions, objections and expenses of ordinary foreclosures avoided.

The debt burden thereby being extended to a practical and satisfactory period, there will be no apprehension on the part of the farm land board. It has already adopted the rule to loan on projects where included in an irrigation district, and though, as I have above explained, this rule unless accompanied by such conditions that the debt burden can be met and prosperity returned, is unwarranted from an investor's standpoint. But by the foregoing suggested amendment you will have brought all irrigation projects within the farm loan bank methods of loaning. The settlers get the full credit to which they are entitled. The government will have returned to it its full investment. The settlers will pay their maintenance and operation as they go, will gradually reduce their cost of construction debt burden, and even though a

small annual reduction it is better than failure of the entire reclamation plan.

Remember the reclamation act only required the return of the "estimated" cost of the projects. This was understood to be, both by the government representatives for several years after the project, and by the water users for many years and at the time of signing up of most of the projects, the cost as estimated at the time of beginning the project, and in all fairness it ought to be so construed now. It is ridiculous, preposterous and absurd to say that Congress intended by the estimated cost to mean the cost after all contracts and experiments and contingencies have been struggled with until the original estimate has been multiplied to 200 per cent and in some cases more than 300 per cent.

There is no such condition, and has never been as referred to by Mr. Raker at page 148 of failure to pay because of want of judgment or laziness; that is, no considerable number. It is not a disease of the projects. The conditions are all general and apply to the most industrious, economical and of keenest judgment. Our people have not and will not organize an irrigation district until some such reasonable, substantial and workable relief is granted, and the moment it is granted farm loan bank loans are available, and besides that private investors will be willing to supply the needs of the settlers with far less red tape delays, and I believe at actually less administration expense.

Mr. Raker on page 145 refers to "the men whom we hear are making all the way from \$50 to \$100 per acre," which shows that he is not familiar with the conditions on these projects, surely not on ours. The Reclamation service published the average income from all lands in its printed report, and this project is a fair average at \$27 per acre. Out of this must be paid interest, water, seed, plowing, leveling, all labor and services, marketing and support of the family. You must not overlook the fact that these reports of \$50 to \$100, and in some cases of \$500 per acre income from land are exceptions. They might be produced from the market gardens around any town in the United States, but will not apply to the general average of any farming community.

He says on the same page: "They seek to subordinate the government's lien in order to borrow money from the Farm Loan Bank to pay the purchase price of the land which they bought from somebody else." This does not apply here. The public lands on this project are in worse position than the private lands. The purchase price of those who hold by purchase, and part of them have been the owners from government title for 30 years, has been in most cases only for the actual improvements on the land. Unless some such amendment, remedy or relief as we have suggested is afforded, you cannot give away the public lands. No one will take them and attempt to pay for the water under any present law, as it is a practical and financial impossibility.

Mr. Lobdell says, same page: "We let the private owner take care of himself. We deal with him, but the settler whom the government invited onto this land cannot get by without some help, and we are asking for opportunity to help him."

Now if Mr. Lobdell will kindly take the trouble to look over some of the government advertising literature sent out concerning these projects, and if he cannot find it, we will send him a copy of the advertising sheet sent out under the signature of the Secretary of the Interior, by which many were induced to come here and invest, not locate on public lands, because the public lands have been withdrawn from the beginning of the project from entry. Absolutely it has been impossible to locate on public lands, but the government has been boosting private lands and inducing settlers to come and buy and locate by purchase from private parties, and the exaggerations of these pamphlets have not been equaled by any real estate schemer in any part of the country.

One form of relief has been suggested by Mr. Herbert Quick: that the government release the lands and retain its security on the water only. He very justly and sensibly says that it is criminal for the government to have required and obtained a lien upon the lands and water. There has been no shark corporation, irrigation outfit in the United States except the government that has

thought of requiring security on the lands as well as the water. All other furnishers of water or builders of irrigation projects have been satisfied with retaining their water rights or ditch stock as security, and which with the right to turn the water off is an absolute protection. I say this because the great injustice that has been caused to these settlers who might have obtained some little credit and been greatly aided in their efforts to get ready to repay for these projects had it not been for this unfair policy, and Mr. Quick has hit the nail squarely on the head.

On page 129 Mr. Norris brings out a matter that should be provided in your amendment; that of anticipating payments and giving a discount. There is no reason why you should not do it. The government can afford to do this as well as any other investor, even though they furnish the money without interest. They can permit a payment to be anticipated certainly on a basis of 3½ per cent discount, or the interest on Liberty Bonds, and reinvest the money in these bonds without loss to the government, and with great advantage to the settlers.

I call your attention to the fact that the government has encumbered our records, and every abstract of every acre in the valley is compelled to pay \$6 or \$7 extra for the abstract by reason of the government's filing to "File and enforce this lien," and that these filings cannot be done away with by any irrigation district. The forming of the irrigation district will add another entry or perhaps two or three, and notice will thereby be given of the entire exact condition, so that it is impossible for the government to loan money on these projects even under an irrigation district without being fully and actually appraised in the abstract of the present law, and the amount of the indebtedness, and that it must be paid in such a time that it is wholly impossible to be met.

Now I have written much more than I intended in the beginning, but the matter is of so great importance to us, and the investigation of the committee thus far has seemed so fruitless, and the real cause of the trouble as well as the remedies, although so plain to us who are, as Mr. Norris says, page 135: "Leading a dog's life, hanging on by our eye teeth," and if the real remedy escapes you there is no likelihood of any relief from any other source; I urge our great necessity as excuse for the time taken.

Yours truly,

F. D. CATLIN.

HOW TO MAKE PRIME HAY

Farmers' Bulletin No. 2, entitled "How to Make Prime Hay," has just come from the press, and is perhaps the most succinct treatise on this subject that has been published. The bulletin comprises twenty pages and is attractively illustrated with photographic reproductions showing excellent views of modern haying machines in action in the hay field. The illustrations show modern methods of making hay, when the clover is in blossom, mowing machines in operation, side delivery rakes in the field, hay in the cock ready to stack, the old way of pitching hay, the hay loader handling a heavy crop, the sweep rake and stacker in full swing, field stacking with hay poles, and the best way to market hay. This treatise on "How to Make Prime Hay" was prepared by Professor A. M. TenEyck, who has had wide experience in experiment station work, and who is now director of the Agricultural Extension Department of the Emerson-Brantingham Implement Company, Rockford, Illinois. A copy of this bulletin will be mailed to any farmer interested enough in making prime hay to write for it.

CONCRETE FACTS ABOUT CONCRETE ROADS

How Any Community Can Get Out of the mud, and stay Out, and at the Same Time Make Borrowing Profitable

What Is a Concrete Road?

Readers of the Irrigation Age who are interested in building roads for permanence, the only way in which our highway funds may be invested rather than wasted, will appreciate the essential facts of concrete road building. Dry facts are usually hard to take, but a dose of dry facts is sometimes necessary for the body politic, and we are here prescribing that kind of a dose. Taken slowly and thoughtfully, you will be in a position to better understand how a road may be built so that it will more than pay back its cost, long before it wears out.

Clean, hard, well graded sand and pebbles or crushed stone, mixed with cement and water to form a mass of quaky or jelly-like consistency, eventually hardens into stone. When such a mixture is laid so that slabs 16 feet wide by from 30 to 50 feet long are formed, you have a pave with a durable, non-skid surface that makes possible higher traffic speed with larger loads drawn by fewer horses or less tractive power—a road open to traffic 365 days in the year—briefly, a concrete road.

How Is a Concrete Road Built?

Successful concrete road construction requires, first, proper preparation of a foundation or subgrade. This means compacting the soil where the concrete is to be laid and providing drainage so that water will not remain under the concrete slabs. Upon the properly prepared foundation, concrete is placed in one or two layers, or courses. This means that some concrete roads are built after what is known as the one-course construction. The first consists of a relatively rich concrete mixture throughout; the second of a somewhat leaner mixture for a base, with a richer top or wearing course applied before the concrete in the base has commenced to harden. Usually where the slabs forming a concrete road are greater than 16 feet wide, or where the road must cross low, frequently wet and hence poorly drained spots, reinforcing in the form of mesh fabric is embedded in the concrete while placing. This assists to prevent the slabs from cracking, either as the result of settlement of the foundation or from the heaving due to frost action. Where suitable materials are obtainable, the one-course type of road is preferable.

High wearing quality of the concrete road results from the using properly graded, clean, hard sand and crushed rock or pebbles. These must be combined with cement and water in proper proportions. Portland cement is a firm binder. It holds the sand or broken stone so tightly together that modern traffic produces but little wear on the surface and cannot dislodge the particles.

What Does a Concrete Road Cost?

Concrete roads cost in the neighborhood of \$15,000 per mile to build. When built, the cost of keeping them in repair, owing to the permanence of concrete, is an average of only \$50 per mile. The enormous annual saving in the maintenance of a

concrete road compared with other types, is shown by statistics gathered from Massachusetts, Connecticut, Rhode Island, New Jersey and New York for eight years. These combined statistics show a total average cost per mile of \$608 for maintenance of roads built with material other than concrete, while a concrete road costs only an average of \$50 per mile per year.

Reduced to an acreage basis and distributed over a period of 20 years under a \$1,500,000 bond issue, the average cost of a concrete road to a farmer living on land valued at \$30.63 per acre is 8¾ cents per acre per year. This estimate is based upon proposed concrete road construction in Vermilion county, Illinois, and Vermilion county has just accepted bids for 141 miles of concrete highway. Distributed over a period of years and equalized among the farmers and taxpayers who are thus enabled to reach their market town 365 days in the year—and more quickly than ever before—with larger loads drawn by fewer horses, the cost of a concrete road is negligible. So a concrete road is relatively cheap because a profitable investment.

Financing the Concrete Road

No extensive road improvement in any community can be carried on without more money than can usually be raised by direct taxation extending through a short term. It is unjust to expect the taxpayers of today to assume the total cost of an improvement which is to last into the next generation, so bonds are usually issued to finance the building of roads that will permanently cut down maintenance expense and reduce hauling costs. These bonds are sold and thus converted into money. Interest on the bonds is paid and the bonds retired by funds obtained from current road taxes. When the bonds have been paid the community still has its concrete roads in excellent condition.

No community can afford to spend its money with less caution than a private individual would display. The community should do likewise. When you are asked to vote for a bond issue to build concrete roads you are not raising public money to spend it, but to invest it. As concrete road mileage in a community is increased, the burden of road maintenance decreases and the saving thus resulting will not only pay interest on the bonds but provide funds to retire them as they fall due. In this way borrowing is made profitable.

How a Concrete Road Benefits the Motorist

Touring possibilities at all seasons of the year and every day in the year go hand in hand with the concrete road. "Safety First" is realized as the result of the non-skid surface. Concrete boulevards through the open country make riding pleasurable by doing away with the jar, dust in dry weather and mud in wet weather. A smooth surface makes steering easy, reduces tire cost, lessens fuel consumption. These are some of the ways in which a concrete road benefits the motorist.

Reduced to simple terms, a concrete road helps

the farmer haul two loads at one trip instead of one load at two trips; or, it doubles the size of the load and cuts in two the tractive power necessary to transport farm produce. With less capital tied up in horses there is more cash to put into equipment to produce more cash. The concrete road reduces the strain on horses and lengthens their lives. It reduces wear on wagons and harness. Where motor trucks are used it lessens tire and fuel expense. It puts the farmer in a state of preparedness to reach markets quickly when prices are best, and he can take his profits and get home with more cash than he could by slow hauling on a bad road. It adds to the acreage value of a farm because it increases its earning possibilities. A concrete road makes all of these advantages permanent, bringing its toll of profit to the farmer daily in the form of time, money and effort saved.

How Concrete Roads Benefit a Community

Concrete roads are country boulevards. They benefit a community in making travel quick, safe, easy, clean and comfortable. They extend neighborhood limits, bring more people into personal touch with each other, increase social opportunities and thereby remove the monotony of isolation; bring greater content to the youth on the farm, make city and country near neighbors, and increase school attendance, thus cultivating a desire for a broader knowledge and higher standards of living.

Concrete roads make daily rural mail delivery a fact; every home unit in the community is put on the news-wire with the political, financial, industrial and trading centers of the earth. The best thought of the world in every line of human effort and human achievement is transmitted over night to the breakfast table of the community served by a network of concrete roads.

A concrete road saves more than it costs. It is open to maximum traffic all the year round. It brings greater freedom and ease of movement in travel and transportation, and permanently increases land values.

All of the benefits derived from a concrete road are lasting.

RUSSIAN NOTES

Immense as has been the railroad development in Russia, the deepening of inland waterways has proceeded at almost the same speed. During the period of time that it has taken the railroads to treble their mileage, the river and canal systems have increased 195.9 per cent. Navigation likewise has kept pace with the increased facilities, steam navigation having increased one and a half times during a period of six years, and the sail and barge craft having doubled.

The Ministry of Ways of Communication in preparing its report gives the following statistics:

During the last five years the inland waterways have borne 30 per cent of the total freight movements of European Russia.

Inland waterway shipping is divided into two classes: steam and other motive power. Steam vessels numbered 4,884 with a valuation of 183,200,000

rubles; sail and barge craft numbered 22,511 at a valuation of 90,000,000 rubles. The development in sail and barge craft has been along the line of tonnage rather than of number of vessels, there being but 15 per cent increase in number of vessels, while the tonnage increase has been more than double. Thus in 1884 the largest craft had a capacity of 3,650 tons, whereas now there are barges on the Volga with a capacity of over 10,000 tons.

Thousands of war prisoners are employed in the improvement of inland waterways, extensive lock systems being built on the Don, Donetz and Sheksni rivers. The enlargement of tonnage with vessels drawing more water has necessitated the deepening of river channels. The same factor has resulted in the broadening of canals, among the most important being Vaserinsk canal of the White Sea to the Petrograd system. By June of this year this canal will have been transformed into a ship canal, making Petrograd an open port.

The importance of the lumber industry in Russia is figuring largely in the plans for Russia's export trade after the close of the war. The demand for building materials will be unprecedented and the vast resources of Russia's forest wealth have scarcely been more than touched. Furthermore, hundreds of square miles of forest in the crown lands, now confiscated, are available for exploitation. With the marvelous increase in the harbor facilities of Archangel and Vladivostock and the extension of railroads in the forested districts, this industry has a big future. In 1913, the last year of normal export, lumber worth 165,000,000 rubles was exported. By the closing of the Baltic ports this export has been reduced to a valuation of 27,200,000 rubles. Vast stores of timber have accumulated, and in Archangel alone 65,000,000 rubles worth of timber is ready for shipment. In 1916, when an increase in exports is noticed, little big timber was shipped, the exports being mainly pine for matches and spruce for paper pulp. Domestic consumption of timber has been large, a considerable quantity being required for military purposes. The demand for railroad ties has been great and the erection of factories all over the country at a time when unusually heavy demands were made upon railroad facilities has caused many of these factories to burn wood instead of coal. As, however, the Ministry of Agriculture possesses a modern and progressive Forestry Bureau, this use of timber fuel is being managed in such a way as to increase rather than deplete the great forests of Russia.

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ONE YEAR AND THE PRIMER OF
IRRIGATION.**

KING HILL PROJECT INVOLVED IN BIG SUIT

T. A. Walters, attorney general of Idaho, in behalf of the state land board, has brought suit against the National Surety Company for \$25,000 on an indemnity bond issued to insure the completion of the work, undertaken by the King Hill Irrigation and Power Company in compliance with the terms of a Carey Act contract made with the state land board.

What is known as the King Hill project comprises a total area of 24,000 acres of fertile land near Glenns Ferry, in Elmore county. The project has had a checkered career, having been first undertaken in 1903 by the Glenns Ferry Land and Irrigation Company, which was succeeded by the King Hill Irrigation and Power Company in 1907. The latter company was controlled by J. L. Hammett, a wealthy oil producer, who came to that state from Oklahoma and who lost his fortune in attempting to complete the irrigation system.

L. L. Nunn, formerly of the Telluride Power Company, acquired the power rights from Hammett and later installed what is known as the Malad River power plant, which he disposed of to the Idaho Power Company about two years ago at a handsome profit.

Owing to bad engineering and unforeseen obstacles in connection with the construction of the ditches, the development of the project proved so costly that it had to be abandoned. In 1908 the project was sold under foreclosure by Judge Frank S. Deitrich of the United States District Court and was bid in by the state of Idaho. Since that time the state has been operating the unfinished irrigation works, but the legislature has declined to appropriate sufficient funds to complete the undertaking.

For some time the state has been endeavoring to induce the federal government to purchase the tract and complete the irrigation system. Such action was recently recommended by Secretary of the Interior Franklin K. Lane, and it is thought probable that the necessary appropriation will be made during the present session of Congress as a war measure.

The completion of the irrigation project will open up one of the most productive tracts in the state, as, owing to the fact that the altitude is only 2,300 feet, the lands are adapted to fruit growing as well as to diversified farming.

NEWS NOTES FROM IRRIGATION PROJECTS OF THE COUNTRY

CALIFORNIA

W. J. Hole of Los Angeles, owner of the La Sierra ranch, lying between Corona and Arlington, has made application before the state water commission for the appropriation of sufficient water from the Santa Ana river to irrigate his property.

Kern County farmers, who hope some day to benefit from the flood waters of Kern river, have just learned that Governor Stephens has recently signed the Hawson amended California irrigation act and thereby paved the way for the forming of the irrigation district in the Kings river conservation district for the construction of the reservoir at Pine Flat, to irrigate one million acres in Fresno, Tulare and Kings Counties. Under the new bill the land owners will be entitled to one vote for each acre of land they own, and assessments will be made according to benefits to be derived from irrigation or drainage. Fifty per cent of the land owners must sign the petition to form the district and have it passed upon by the irrigation board of the state.

By a large vote the people of the Imperial Valley have sanctioned the issuance of \$2,500,000 in bonds for flood protection and irrigation improvements. Directors of the Imperial Irrigation District are striving this year to provide water for 50,000 additional acres.

Co-operating with the Northern California Counties' Association, officials of the Trinity National Forest have begun a campaign to form an irrigation district in Hayfork Valley, which will bring under irrigation about 8,000 acres of the best land in Trinity County. The water necessary for irrigation will be taken from Salt creek and will be conserved for use during the low water month by a dam which will back the creek up, forming a lake some two or three miles in length.

Following the receipt of notice of the validation of the \$350,000 bond issue of the Paradise irrigation district, the directors and contractors are rushing preparations for work. The bonds have been sold. Sixty men have started to work on the dam for the reservoir in Little Butte creek near Magalia and the system will be completed not later than January 1, 1918.

State Controller John S. Chambers has certified to the bond issue of the Westside Irrigation District following approval of the issue by the State Irrigation District Bond Commission. The district embraces 11,000 acres of land located in San Joaquin County, near Tracy. The bond issue amounts to \$295,000.

The Panoche Canal Company has been granted permission by the State

Water Commission to use 962½ cubic feet in water from the San Joaquin river in Fresno County from April 1 to July 1 of each year. The company will use the dam of the San Joaquin & Kings river Canal and Irrigation Company. The other works consist of a main canal five miles long and three pumping plants lifting the water to three levels. The number of acres to be irrigated is 77,000 and the estimated cost of the project is \$500,000.

IDAHO

W. L. Wells, Carey Act agent for the Federal Department of the Interior, has been in Idaho recently getting data on Idaho irrigation projects from the state engineer. He has been making an investigation of the Lost river project in Butte County and the Houston project in Bonneville County, and he will compile reports on both of them for the government.

The reorganization of the Crane Creek and Sunnyside irrigation project near Weiser is to be undertaken at once by Pennsylvania capitalists. The Pittsburgh Bank for Savings, a concern which went into the hands of a receiver some months ago, owns Crane and Sunnyside projects bonds to the amount of \$300,000. When the bank failed, its affairs were taken over by the office of the Pennsylvania attorney general, with the result that an

investigation of the unsuccessful project was immediately inaugurated. E. E. Anderson of Sharon, Pa., who is representing the attorney general, Geo. H. Edwards of the Commonwealth Trust Company of Pittsburgh, and R. E. Shepherd, now of Jerome, have been appointed a committee to effect its organization. Reclassification and segregation of the land is to be begun as soon as the details of the scheme of reorganization are announced.

According to information received by the Lewiston land office, probably 1,500,000 acres of land now held from entry within irrigation projects in Idaho, where the irrigation systems have never been completed, will be turned into the public domain and thrown open for entry in the near future.

The Mountainhome Co-operative Irrigation Company must make a large number of improvements on its system if it complies with suggestions contained in a report made upon it by J. H. Smith, state engineer. In conducting the investigation the state engineer also investigated the works of the Elmore Irrigated Farms Association. He says the two systems are owned by the same interests. He recommends the construction of new canals, and the riprapping of many of the larger canals, new headgates and laterals.

As a result of the alleged failure of the King Hill Irrigation and Power Company to live up to the terms of its Carey Act contract with the state, the State Land Board has brought suit against the National Surety Company for \$25,000 on an indemnity bond issued to insure the completion of the work. What is known as the King Hill project comprises a total area of 24,000 acres of fertile land near Glens Ferry in Elmore County. The project was first undertaken in 1903 by the Glens Ferry Land and Irrigation Company, which was succeeded by the King Hill Irrigation & Power Company in 1907. Owing to bad engineering and unforeseen obstacles in connection with the construction of the ditches, the development of the project proved so costly that it had to be abandoned. In 1908 the project was sold under foreclosure and was bid in by the state of Idaho. Since that time the state has been operating the unfinished irrigation works, but the legislature has declined to appropriate sufficient funds to complete the undertaking. For some time the state has been endeavoring to induce the federal government to purchase the tract and complete the irrigation system. Such an action was recently recommended by the Secretary of the Interior, and it is thought probable that the necessary appropriation will be made during the present session of congress as a war measure. The completion of this irrigation project will open up one of the most productive tracts in the state as owing to the fact that the altitude

is only 2,300 feet, the lands are adapted to fruit growing as well as diversified farming.

OREGON

The Desert Land Board recently unanimously passed the resolution of State Engineer Lewis, under which the state relinquishes all of its right, title and interest in the Benham Falls project near Bend. The project is a portion of the Central Oregon Irrigation Company plan. The resolution will be slightly modified to make stronger a recommendation that the land remain intact to be used in the future as an irrigation project.

Farmers met at Crane recently to consider plans for an irrigation district serving 50,000 acres with water from the Silvies river. The cost of the project is estimated at \$30 per acre.

UTAH

C. J. Ullrich, assistant state engineer, has recently made the first survey provided for in the new irrigation district law in Utah. Mr. Ullrich made an investigation of the property of every water user in the proposed Springville and Mapleton irrigation district and determined the amount of water now appropriated to each, and the amount it requires in addition to make it completely productive. A total of 376 tracts were examined in the proposed Mapleton district and about 500 in the proposed Springfield district. About 6,200 acre feet under his survey are allotted to Mapleton and 2,365 to Springville. The water for irrigation is to be taken from the Strawberry reservoir, built by the Reclamation service, and for the district a new canal is to be built from Spanish Fork creek.

Albert F. Mathis of New Harmony, Washington County, has filed application for a second foot of water from Bumble Bee creek in that county to irrigate 80 acres of land. The application states that flood waters will have to be utilized by winter irrigation and that this system has been found advantageous in that part of the state.

Articles of incorporation have been filed by the Lake Fork Irrigation Company of Monticello. Authorized capital stock \$25,000 in 45 shares. The officers of the company are Brigham Spencer, president; H. J. Wilson, vice president, and Geo. A. Cole, secretary and treasurer.

The North Willow Irrigation Company has filed an application asking for 10 second feet of water from the North Willow and Davenport creeks in Tooele County, to be conducted through a 16-inch pipe line and to irrigate 2,000 acres. Tunneling construction also is provided for.

Application for three second feet of water for irrigating purposes, to be taken from Shoal creek in Washington County, has been filed with the

office of the state engineer by Job F. Hall of Enterprise. Jos. B. Lee of Grouse creek, Boxelder County, has also asked for the use of one second foot of water to be taken from Dry creek for irrigation purposes.

J. H. Monson of Price has filed application with the state engineer for use of five second feet of water from Cordingly creek in Carbon County for irrigation of 160 acres of land.

Articles of incorporation have been filed by the High Line Irrigation & Reservoir Company, with headquarters at Escalante, Garfield County. Authorized stock \$40,000 in \$5 shares. E. A. Griffin, president; A. M. Sherman, vice-president, and Jos. Larsen, secretary.

The Perry Irrigation Company has filed articles of incorporation. Headquarters of the company are located at Perry. Capital stock of the company, \$49,632.50.

WASHINGTON

The state supreme court has ruled in favor of Ham, Ycarsley & Rylie in their fight for the use of the waters of Moses lake for an irrigation project. The project is designed to put 12,000 acres of land under irrigation in Grant County. The action was brought by the Grant Realty Company and three different times the case has gone up to the supreme court on various claims. The decision as finally rendered by the supreme court gives the local company the right to condemn the damsite and use the water claimed by the Grant Realty Company.

The Department of the Interior does not look with favor upon the plan of the commercial organizations of the Yakima Valley to extend the Wapato irrigation project as a war measure in order to increase the production of food stuffs. Senator Jones recently submitted to the department of the Council of National Defense the suggestion that a reimbursable appropriation of \$1,500,000 be made to extent the project. Acknowledging this suggestion the department says that the present lateral system is quite sufficient to exhaust the entire carrying capacity of the existing main canal of the project, and any enlargement would necessitate an extension of the present canal system. He further points out that the cost of making such an enlargement would be especially large at this time.

MISCELLANEOUS

Under authority from the Secretary of the Interior contract has been let to Lynn Bros. & Peterson of Lovell, Wyo., for earthwork on the Second Unit, Frannie Division, Shoshone irrigation project, Wyoming. The work involves approximately 30,000 cubic yards of excavation, and the value of the contract is approximately \$4,500.

Pumping for Irrigation

We are presenting herewith a view of Pumping Plant No. 2 on the Demonstrating Farm of the Texas Land and Development Company holdings near Plainview, Texas.



Irrigation scene on lands of Texas Land and Development Company, showing 1,500 G. P. M. discharge of "American" deep well centrifugal pump flowing over two borders, each 50 feet wide by 660 feet long.

This plant has been in service for the past four years, supplying water to irrigate 200 acres of mixed crop, such as alfalfa, wheat, maize, oats, etc.

The pump used is an American 24-inch 2-stage turbine, delivering 1,500 G. P. M. at a total lift of 75 feet, and during the past four years' service it has never been removed from the well for repairs.

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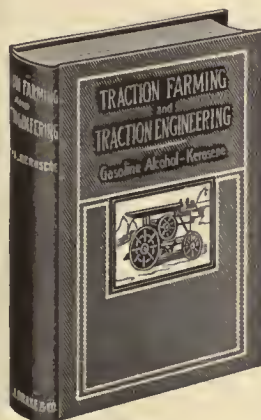
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The Cherokee Land, Irrigation and Investment Company of Wilmington, Kansas, has filed articles of incorporation with the Texas Secretary of state. The Texas office of the company is located at Morrill. S. V. Biggers of Morrill is the Texas agent of the company.

Under authority from the Secretary

of the Interior the U. S. Reclamation Service has awarded contract to Fairbanks, Morse & Co. of Denver, Colo., for furnishing pumping machinery for the Yuma Valley drainage plant, Yuma Irrigation Project, Arizona. The pumps are of the screw type with related apparatus. The contract price is \$23,290.50.

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Thirty-Second Year

THE IRRIGATION AGE

VOL. XXXII

CHICAGO, AUGUST, 1917.

No. 10

THE IRRIGATION AGE

With which is Merged

The National Land and Irrigation Journal

MODERN IRRIGATION

THE DRAINAGE JOURNAL

THE IRRIGATION ERA

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THE IRRIGATOR

D. H. ANDERSON

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Official organ Federation of Tree Growing Clubs of America. D. H. Anderson, Secretary.

The Executive Committee of the National Federation of Water Users' Association has taken action whereby THE IRRIGATION AGE is created the official organ of this vast organization, representing 1,000,000 persons on the government irrigation projects.

The editor of THE IRRIGATION AGE Salt Lake City returned recently from a trip to Salt Lake and Los Angeles and completed arrangements while in Salt Lake City for the removal of the plant of THE IRRIGATION AGE to that city from which point it will be issued beginning with the October, 1917, issue, which will appear in double its present form and number of pages. This move has been under consideration for the past 15 months and was only brought to a definite conclusion during the recent visit as above stated.

The plan of the publisher is to work in connection with all of the Water Users' Associations of the various Federal projects and close relations will be established with the Water Users under all Carey Act, District and private projects and arrangements are now under way to establish headquarters in that city for a gathering place for all interested in irrigation as well as a meeting place of the annual congress of the Federation of Water Users.

The writer is in communication with Mr. O. W. Farnham of Newell, South Dakota, and has requested that he join in a trip to each project, 26 in all, with a view to reorganize the Federation on broader lines so that a preliminary meeting may be held in Salt Lake City this Autumn when officers will be elected and organize a general plan of operation so that annual congresses may be held in that city in September or October of each year.

The inducements for moving this publication to Salt Lake City are many; among which and most

prominent is the fact that this city is located in the geographical center of all irrigation activity in the United States. This move will, moreover, bring the editors in closer touch with the leading experts in irrigation who are to be found at the universities of the states west of the Missouri River. It will be the aim of the editor to secure the co-operation of the brighter minds in this field so that articles concerning their research and development may be published in each issue of this journal.

A general notice will be sent out later giving date of transfer of THE IRRIGATION AGE to this new field.

It may interest our friends to know that we have received a guarantee of 50,000 new subscribers in the Intermountain territory within one year of the date of the establishment of this journal in Salt Lake City

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Hon. F. W. Mondell, Congressman from Wyoming, is a candidate to succeed Senator Warren of that state who has announced he will not run again.

This is good news to those who know Frank W. Mondell and who are familiar with his history and his efforts to aid in a clean development of our Western Empire. It is safe to say that no member of Congress has worked harder for his state and the west during the past 16 years than has Mr. Mondell.

The Editor of THE IRRIGATION AGE sincerely hopes that he may succeed Senator Warren.

Harness The Colorado River There is a movement on foot among the advanced thinkers of the west to form a feasible plan for storage of the upper waters of the Colorado River and its tributaries and an effort will eventually be made to induce the Government to make an appropriation for this purpose.

This plan of storage embraces a system of reservoirs on the tributaries of the Colorado so that the water may be held in check during the flood time and so equate the flow and protect the lower irrigated areas in the Yuma country and Imperial Valley against floods which have ever been a menace to this exceedingly productive section.

As an illustration, the principal railroads were compelled during the past season to keep hundreds of cars loaded with rock on tracks laid on the levees to prevent a break which would have caused a loss to the settlers of crops amounting to between 30 and 40 millions of dollars. The breaking of one of these levees would have let in a volume of water sufficient to, temporarily at least, flood all cultivated areas in the Imperial Valley and it is, indeed, doubtful if a similar break, such as was encountered some years ago and checked only after superhuman effort and the expenditure of nearly 2 millions of dollars by the Southern Pacific Railway Co. could be repaired so as to permanently protect the valley.

Those who read the story "Barbara Worth" will have obtained a faint idea of the strenuous work necessary to stem this great flow and again force it back into its natural channel. The Salton Sea covering thousands of acres of fertile land in the lower parts of the valley is a permanent reminder of the power and destructiveness of this immense volume of water; a distinctive feature to any effort to impound and control is the fact that all waters held in reservoirs on the upper Colorado and its tributaries will permit the engineers to equate the flow lower down, after first being used to irrigate lands along these upper reaches and then brought back into supplemental storage basins from which power may be developed in its course to the sea.

The men who are planning this great undertaking will perform a service not only to the railroads, but are at the same time opening up large areas for settlement in the valleys along the upper streams which under present conditions and without this storage would forever remain dormant and unproductive.

This general plan is so far-reaching and of such magnitude that it is the opinion of the writer that every true westerner may feel proud to assist in its development.

Want Project Heads Ousted Prompt dismissal of officials of the Boise-Payette Irrigation Project responsible for the "deplorable condition that now confronts the farmers" was demanded in a resolution passed on at a mass meeting of 450 Water Users held recently in Caldwell, Idaho.

Inefficiency of the Reclamation Service and the incompetency and neglect of the local officials by failing to see that the Deer Flat reservoir was well filled for the present irrigation season is charged in the resolution. An investigation of the Reclamation Service by Congress also is recommended. By a subsequent motion, Secretary Magee of the Water Users' board was instructed to telegraph the resolution to the Idaho delegation in Congress, with the added request that they help initiate an official inquiry on the part of Congress.

The text of the resolution adopted by the mass meeting follows:

"Whereas a call has been made upon all producers from the soil to increase the production of foodstuffs for ourselves and our allies; and

"Whereas the farmers of the Boise project, responding to that call, have expended their full strength, both financially and physically, in their effort to do their 'bit' in the defense of their country; and

"Whereas there has been constructed by the reclamation service an irrigation and storage system for the proper irrigation of about 250,000 acres of fertile land at a cost of upward of \$12,000,000; and

"Whereas the snowfall in the mountains has never been excelled and the prospects for abundance of water for the proper irrigation of the lands has been and is now better than ever before and the Boise river has been running at flood; and

"Whereas in the midst of the irrigation season, when the demand for irrigation water is the greatest, we, the water users of the Boise project, find, to our great injury, the Deer Flat reservoir is now practically empty; and

"Whereas there is a large acreage of wheat and other crops, representing millions of dollars to the farmers and to the government, dying for the want of irrigation water; and

"Whereas the cause for the deplorable condition that now confronts the farmers upon the Boise project is due to the inefficiency of the reclamation service and the incompetency and neglect of the local officials of the reclamation service by failing to store in the Deer Flat reservoir during the fall of 1916 and the spring of 1917 sufficient water for the proper irrigation of the lands; therefore, be it

"Resolved by the water users in mass meeting assembled, That the officials in charge of the Boise project and who are

responsible for the conditions existing upon this project should be dismissed from the service and that their successors in office be submitted to the board of directors of the Water Users' association for approval, to the end that we be given immediate relief from the intolerable conditions that exist and that a congressional investigation of the affairs of this project be made."

This meeting and resolutions are evidently a culmination of a long-standing protest on the part of the settlers who have made little headway in their encounters with local officials of the Reclamation Service.

At the time the writer visited Caldwell in June

of this year, Director Davis and Judge King, Chief Counsel, were at Boise, but apparently ignored that branch of Water Users which was represented in this meeting.

At that time Mr. Magee stated that "the time had come when the education of the Water Users on Government projects of the incapacity of the Reclamation officials must be undertaken."

This meeting was, no doubt, a result of an effort to get the members of the association together so that some weight would be given any resolution presented and passed, and it is our opinion that the authorities in Washington cannot easily ignore so decided and emphatic a protest.

TAKING OVER THE PROJECT

In a recent issue of the Montrose Enterprise, Montrose, Colorado, Mr. Chas. A. Block offers the following suggestions.

In view of the importance of this move on the part of the Water Users, great caution should be used as this venture will be watched with interest by officials of other projects who may later demand similar concessions.

The water users will be asked in the near future to vote on practically the tentative agreement reached between Secretary Lane and the committee that visited Washington about two months ago.

The provisions of these agreements are embodied in the letter of Secretary Lane to Dr. McClanahan, president of the Water Users' association, as published in our local papers about the end of May.

A discussion of the secretary's letter, therefore, is timely and of importance to all water users. For this reason, I wish to touch on a few points, as I see them.

As the project must be taken over by the Water Users' association sometime in the future, the sooner they take charge of the management, the better it may be for all concerned.

However, the water users are taking a great risk, which may prove costly to them, in taking over the management of the entire plant at once. It may be prudent for them to take over only part of the plant at a time, so as to limit losses and errors to a minimum, maintain the greatest efficiency, build up an efficient organization, etc. For instance, a good plan might be for them to take over the management of the Ironstone canal and all the land on that side of the river below the canal for the first year. If at the end of that period, the management has proven successful, then they could take over the Montrose & Delta canal, and all land on that side of the river the second year. If this has proven successful, then the Selig and the tunnel could be taken over by them.

It also may be well for the water users to consider, that in taking over the management of the entire project they must have a considerable amount of money on hand in the bank for running expenses, and also an emergency fund of at least \$100,000.

The stockholders of the association either must be assessed for these necessary funds or the association will be compelled to issue bonds, and right there the water user will begin to pay interest.

Now, if the association took over the management of only a part of the project, its running expenses would be much less and the emergency fund could be gradually accumulated by comparatively small extra annual assessments, the payments of which no one would feel. This fund could be invested in some readily available security such as liberty bonds. Thus instead of paying interest, the water users would be receiving interest.

Mr. F. H. Newell, in his book on "Irrigation Management" has the following to say on the "Transfer of Control": "The irrigation project built by a corporation or by the government is destined ultimately to go into the hands of the water users. The sooner this transfer is made the better for all concerned, if the water users will accept the full responsibility and employ men of experience. The manager who is thus acting as agent of the original builders must look forward to the time when the water users themselves will exercise more direct control and make such provisions as may be necessary toward aiding the water users in appreciating the responsibilities which they should assume.

The manager of the project which has already passed through this period and which is being operated and managed by the water users themselves, has, of course, a somewhat different set of problems, but the manager who, as above stated, is acting for the government or an outside corporation, must make a definite effort to bring to his water users a realization of future duties. It is apparent that there cannot be any divided control, but as the irrigators acquire more experience there would be put upon them a large and larger share of definite responsibility.

ity. The heterogeneous mass of settlers when first brought together on a new project evidently do not have sufficient acquaintance in business to handle in a successful manner a large irrigation system. After a few years, however, the social order gradually establishes itself, experience teaches many important facts, and it becomes possible for irrigators to pass upon certain problems. This they should be urged to do, otherwise they have no conception of the difficulties involved nor appreciation of the efforts and results attained by the project manager.

The immediate conveniences or economies of administration should not be permitted to outweigh the necessity and desirability of giving the settlers experience in these matters, so that when the time arrives when they must operate the canal system as an incorporated body, they can do this upon the basis of actual results. This experience, however,

credits for the water they claim to have, and that the price per acre is to be determined by dividing the actual cost of the project when finished by the number of acres subscribed on the first of August plus the irrigable acreage of public land. This will, in my opinion, boost the construction charges way above what they would have been if the committee had never gone to Washington to get them reduced. I do not have any idea how much land the association will release or how much credit they will allow on old priorities, but whatever these items may amount to, the other land holders will have to pay.

Without doubt the water users, excepting those whose interests are directly involved, will do better to let these matters be adjusted by the Reclamation service. Their legal department is especially prepared and equipped to handle just these kind of cases.



A California Irrigation Scene Showing Water Distribution.

should be obtained in a small way at first, where the outcome will not be destructive. It is better to endure the disappointments or occasional hardship of community management of certain details on a small scale, if by so doing experience is gained which ultimately leads to safe operation of the entire system.

There are in the United States few large irrigation systems except those recently constructed by the government and Carey projects, which are not operated under the co-operative plan by the irrigators, and it is doubted whether it is practicable for an irrigation system to be operated in the United States for any very long period of time on any other basis than directly by the settlers.

You will notice that provision 3 permits the association to release subscriptions, fix present priorities to land held by these owners, or give them

I do not think the association should try to adjust these cases, because it is a practical certainty that any board of directors of the association or any special committee appointed by the board or association will have some members who are themselves interested, either directly or indirectly in the matters at issue. The legal fees and other expenses incurred in making these investigations, etc., also will be excessive.

The suggestions here indicated are of such good nature, that they do not in any way conflict with the interests of the government, and therefore, there can be no good reason why the secretary should object to them. On the other hand, they are of a beneficial nature to the water users, and therefore, in direct line with the object for which the Reclamation Service was organized, namely, to make a success of the project.

PRELIMINARY REPORT ON KEARNEY VINEYARD EXPERIMENTAL DRAIN FRESNO COUNTY, CALIFORNIA

By WALTER W. WEIR, Senior Drainage Engineer, U. S. Department of Agriculture

(Based on work done under a co-operative agreement between the Office of Public Roads and Rural Engineering, U. S. Department of Agriculture, and the University of California Agricultural Experiment Station.)

Introduction

The need for drainage in many of the irrigated sections of the San Joaquin Valley was noted and



Fig. 1—View showing character of vegetation in 1913.

reported upon by the late Dr. E. W. Hilgard¹ as early as 1886. In 1902 C. G. Elliott² surveyed and reported upon the drainage of about twenty-five square miles of territory in Fresno County and in a subsequent report³ recommended drainage for the city of Fresno. In 1907 W. W. Mackie⁴ reported on experiments in drainage that were carried on by the Bureau of Soils, U. S. Department of Agriculture. In 1909 Dr. Samuel Fortier and V. M. Cone⁵ reported on experimental drainage in the Fresno section and made preliminary recommendations for the drainage of about 200,000 acres.

With the idea of making further experiments on a larger area than had been previously used and of carrying these experiments to a more definite conclusion than those of former cases, the Kearney Vineyard experimental drain was installed under the co-operative direction of the University of California Agricultural Experiment Station and the Office of Ex-

periment Stations, U. S. Department of Agriculture.

Although this tract has not yet been brought to an entirely satisfactory state of productiveness, the results have been such as to give indication of the entire success of the project. This preliminary report is intended to show only what progress has been made during the first three years.

Location

The drained tract, which consists of a quarter section (S.E. $\frac{1}{4}$ sec. 6, T. 14 S., R. 19 E. M.D.M.) of the Kearney Vineyard property, lies one mile northwest of Kearney Park and about eight miles west of Fresno, along White's Bridge Road between Fillmore and Monroe Avenues.

History of the Tract

About 1890 this tract, which is a part of what was then known as the Fruit Vale Estate, was brought into productiveness as a vineyard by Mr. Theodore Kearney. It is said to have been as valuable as any part of the estate during the first years. Later seepage and alkali began to appear and the vineyard deteriorated rapidly until all but a small portion was removed. The

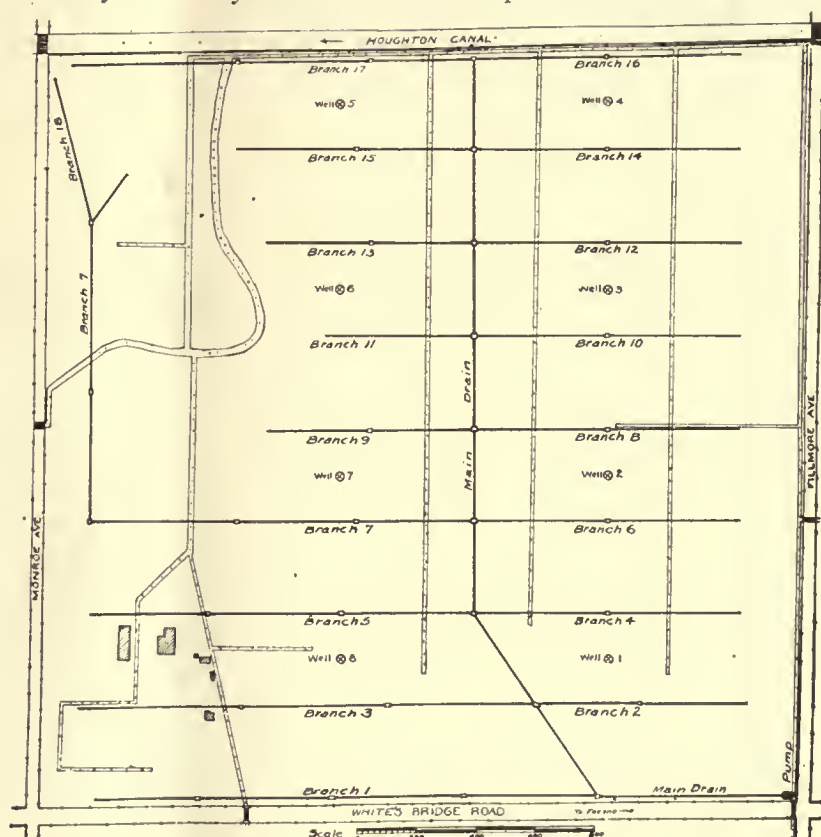


Fig. 2—Sketch showing location of drains and test wells on Kearney Vineyard Experiment Drain.

1. Reports of California Experiment Station, 1886 to 1896.

2. Circular 50, Office of Experiment Stations, U. S. Department of Agriculture.

3. Circular 57, Office of Experiment Stations, U. S. Department of Agriculture.

4. Bulletin 42, Bureau of Soils, U. S. Department of Agriculture.

5. Bulletin 217, Office of Experiment Stations, U. S. Department of Agriculture.



Fig. 3—Drainage system under construction. Note depth of trench.

tract was then planted to alfalfa, which gave satisfactory yields for a few years, but the water table continued to rise until the alfalfa became unprofitable and the entire tract was used for grain up to the time that the reclamation work was started. In 1912 the entire quarter section produced only about 30 tons of barley hay and this largely from the sandy ridge in the northwest corner of the tract. In 1913 the tract was uncultivated, some parts being entirely barren of vegetation, while a rank growth of alkali weeds and foxtail covered most of it.

Preliminary Survey

During the summer of 1913 detailed topographical, soil and alkali surveys were made of the area. The topography is somewhat irregular, the general slope is about $2\frac{1}{4}$ feet from north to south. A sandy ridge runs through the northwest part of the field, with a deep depression just to the west. A shallower depression lies just east of the ridge, and a broad, flat area extends from this through the middle of the field. With the exception of the one deep depression, the local differences in elevation are less than two feet.

The soil is mapped by the Bureau of

Soils⁶ as "Fresno sandy loam," whereas the more detailed survey mentioned separated it into the sandy loam and fine sandy loam types, each occupying irregular shaped areas over the tract. Practically the entire area is underlain by hardpan at depths ranging from a few inches to several feet, of a thickness ranging from a few inches to four feet. Sometimes several layers of hardpan were encountered within a six-foot soil column. Hardpan conditions varied considerably within short distances, and, as was found later, offered little resistance to the downward movement of water.

The detailed survey showed that the alkali varied in the surface foot from less than .2 per cent over most of the tract to 3.0 per cent over small areas. It was found that the principal salts were sodium chloride and sodium carbonate, with a predominance of the former. Observations taken during 1912 and the early part of 1913 showed that at no time during the year was the water table more than seven and one-half feet below the surface, and during June it stood within two feet of the surface. During the entire growing season the water was less than six feet from the surface, and for four and one-half months was less than four feet below the surface.

Plan of Drainage

The system of drainage installed during November and December, 1913, consists of a main drain, beginning near the center of the north line of the tract, running south to within about 600 feet of the south line, thence southeastward 750 feet and thence east to a sump at the southeast corner. The main drain has a fall of 1 in 1,000 and an average depth of about seven feet. As originally constructed, the upper 300 feet were 6-inch tile, followed by 1,588 feet of 8-inch tile and 1,400 feet of 12-inch tile. The

6. Field Operations of Bureau of Soils, 1912—Fresno Area.



Fig. 4—The tract was flooded in order to wash the alkali down.



Fig. 5—The corn grown in 1914 showed many bare spots.

lateral system, consisting of eight parallel laterals on the east and nine on the west side of the main, is composed of 6-inch tile at an average depth of five and three-quarters feet. The laterals are 315 feet apart, those on the east of the main drain being 900 feet long, while those on the west, due to the topography, vary from 500 feet to 1,700 feet long. Branch No. 7 differs from the others in that it extends north along the west line in order to reach the deep depression at the northwest corner of the tract. The tile, with the exception of 640 feet of 12-inch sewer pipe, was ordinary hard-burned clay drain tile in two-foot lengths. Each piece was laid to grade with abutting joints. No protection was provided at the joints for keeping out silt.

Concrete silt wells were placed along the main drain at the points where the laterals enter, and at distances of not more than 500 feet apart on the laterals. These silt wells vary in size from 4×4 feet to $2\frac{1}{2} \times 4$ feet and have an average depth of about eight feet. The bottom is in each case one and one-half feet below the tile grade. The sump at the southeast corner of the tract consists of a reinforced concrete pit five and one-half feet square and sixteen feet deep, with the inlet tile four feet from the bottom. The water was originally pumped from this sump with a $3\frac{1}{2}$ -inch vertical centrifugal pump operated by a 5 H. P. direct-connected motor. The irrigation laterals were lined with concrete at all points where they crossed the tile lines to prevent excessive seepage into the new trenches. Fig. 2 shows the plan of the system.

Construction and Cost in 1913

Construction was done by contract, the contractor receiving a commission of 10 per cent on the labor and materials, exclusive of tile and pumping equipment. This arrangement, however, was not strictly adhered to as both labor and materials were furnished without commission. The trenches were all dug by hand and at no place except in the vicinity of the sump was any water or serious caving encountered.

The system consists of 21,842 feet of drain varying in size from 6-inch to 12-inch tile, including 640 feet of 12-inch sewer pipe used for the lower end of the main line because of the deep cut here. The tile cost $7\frac{1}{4}$ cents per foot for 6-inch, 13 cents per foot for 8-inch, and 26 cents per foot for 12-inch, totaling \$2,018.55 or an average of \$0.0924 per foot, f. o. b. Kearney Park. Distributing the tile, digging trenches, laying, backfilling, tools and repairs amounted to \$4,352.38, divided as follows:

Digging and laying.....	\$2,935.42
Backfilling	293.99
Supplies and blacksmithing	821.17
Commission	301.80
	<u>\$4,352.38</u>

The structure, including the material and work on the silt wells, irrigation crossings and sump, amounted to \$2,066.24, of which \$1,015.34 was for materials and \$164.45 for commission. This was divided approximately as follows:

Sump	\$ 500.00
Thirty-four silt wells.....	1,258.00
Twenty-eight crossings	308.24

The pump equipment cost \$561.35, divided as follows:

Transformers	\$160.00
Pump, motor, etc.....	401.35

A summary of the cost of the drainage plant as installed in December, 1913, on a basis of 151 acres of arable land, is given in the following table:

Item—	Total	Per acre
Tile	\$2,018.55	\$13.37
Digging and laying.....	2,750.67	18.23
Distributing tile	184.75	1.22
Backfilling	293.99	1.94
Supplies and blacksmithing...	821.17	5.44
Sump	460.00	3.05
Silt wells	1,163.55	7.70
Crossings	278.24	1.84
Pump equipment	561.35	3.71
Commission	466.25	3.09
	<u>\$8,998.52</u>	<u>\$59.59</u>

The cost of installing the tile was:

Item—	Total	Cost per foot of drain
Tile	\$2,018.55	\$0.0924
Digging and laying.....	2,750.67	.1259
Distributing	184.75	.0085
Backfilling	293.99	.0135
Supplies and blacksmithing...	821.17	.0376
	<u>\$6,370.93</u>	<u>\$2.917</u>

Immediately after the completion of the drainage system, steps were taken to prepare the land for flooding. This work consisted of repairing the irrigation system and rechecking the field, both of which had become neglected through disuse. The repairs to the irrigation system cost \$235.17, or

\$1.56 per acre, and the level cost \$725.56, or \$4.80 per acre, making a total expenditure at the time flooding was commenced in February, 1914, of \$9,959.25, or \$65.95 per acre.

Operations and Expenses During 1914

The first actual work of removing the alkali and lowering the water table was begun by starting the pump on February 23, 1914. At the same time water was turned into the field for flooding. The flooding continued intermittently until April 22, at which time all of the tract except about forty acres along the west line had been flooded for at least a week, to a depth of six to twelve inches.

Shortly after the flooding began, it became apparent that the pumping equipment was too small to handle the water, and an auxiliary gasoline outfit was installed at one of the silt wells at about the middle of the field. The auxiliary pump was kept in operation until June 30 and the discharge was used for flooding. During the operations of this pump it is estimated that 46,000,000 gallons were pumped by it, practically all of which was returned to the land and no account is taken of this in subsequent estimates on discharge. It is now thought that this outfit did not assist materially in lowering the water table, as nearly all of the water which did not evaporate was returned to the drains and eventually handled by the main pump.

During June, the east eighty acres of the tract were irrigated, plowed and planted to Egyptian corn. The stand of corn was rather unsatisfactory, probably not more than paying for its harvesting. It did, however, give some indication as to the progress of the reclamation.

At the end of the 1914 season several instances of faulty design were apparent and changes were made in the system to correct these.

The 3½-inch vertical pump and 5 H. P. vertical motor were found to be both too small and of poor design for this work, and they were replaced by a 5-inch horizontal centrifugal pump and 7½ H.P. direct-connected motor. This new equipment included changes in the pump house and a device for controlling the discharge. It was also found that a considerable portion of the water entering the main line of the tile system came from the laterals near the northern end of the field, evidently seepage directly from the Houghton Canal; from observations made while the auxiliary pump was in operation, it was found that portion of the main line were too small and probably would not have handled satisfactorily the entire drainage even if the pump equipment had been larger. As a consequence, all of the 8-inch tile was replaced by 12-

inch tile and all of the 6-inch tile in the main line by 10-inch tile. The total expenses for the year were as follows:

Item—	Total	Per acre
New pump equipment.....	\$ 377.10	\$2.49
Tile replaced	373.76	2.47
Labor replacing tile.....	686.50	4.55
For flooding	218.06	1.44
Pumping (both pumps).....	684.02	4.54
Auxiliary pump	148.84	0.98
Plowing (Bermuda grass control)	296.70	1.97
Maintenance of tile line.....	28.00	0.18
	<hr/> \$2,812.98	<hr/> \$18.63

Total for the project at the beginning of 1915 season, \$12,772.23, or \$84.58 per acre.

Aside from the changes which have been mentioned, it now became apparent that considerable of the first cost might have been saved by a more economical design of the structures. The concrete linings in the irrigations laterals were found to be of no real service, and could have been omitted entirely. Equal efficiency could no doubt have been obtained by omitting all of the silt wells except those on the main line and one on lateral No. 7, and by using redwood instead of concrete in their construction.

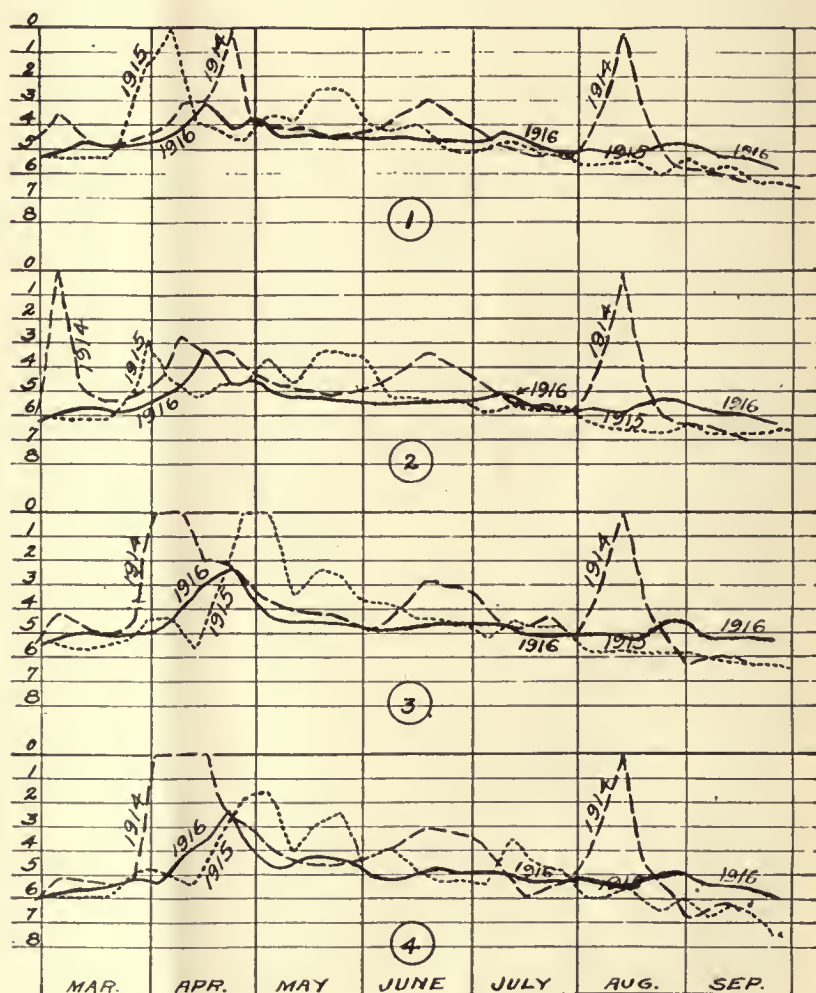


Fig. 6—Curves showing ground water table on Kearney Vineyard Experiment Drain.

During the construction of the sump, adverse subsoil conditions were encountered which no doubt increased the cost of the sump by several hundred dollars over what it would have cost if located elsewhere. It is probably also true, although as yet not conclusively proven, that equal efficiency could have been obtained by spacing the laterals about 400 feet apart, instead of 315 feet, thus eliminating one on each side of the main drain. This last change could certainly have been made had the laterals been placed eight inches to one foot deeper. These duplicate and apparently unnecessary expenditures were caused in the first instance, because it was found that the measured drainage discharge for this tract is more than double that usually found in irrigated sections, and in the second instance, by the experimental nature of the undertaking.

Operations and Expenses During 1915

Immediately after flooding operations were discontinued in 1914 a rank growth of Bermuda grass sprang up over the tract, replacing the growth of alkali weeds which were so abundant in 1913. It is probable that some of the seed of this grass was brought to the field by the water used in flooding and also there seems to be little doubt but that much of it was dormant in the soil and started to grow as soon as growing conditions were improved. It now became apparent that before successful crops of alfalfa could be grown the Bermuda grass must be eradicated and, consequently, after the second flooding, which took place in April, 1915, and covered practically the same area as was flooded the previous year, the entire season was spent in attempting to control this grass. The tract was plowed to a shallow depth several times, so as to expose the roots to the hot sun. The loosened grass was raked together and burned. The end of the season showed a very marked reduction in the amount of Bermuda grass present. During the year 1915 the following expenses were incurred:

Item—	Total	Per acre
Maintenance and repairs to drain and pump	\$70.64	\$0.47
Repairs to irrigation system....	95.50	0.63
Pumping costs (power, etc.)....	278.15	1.90
Flooding	149.38	0.99
Control of Bermuda grass.....	1,843.48	12.21
	\$2,447.15	\$16.20
Total for project, January, 1916.	\$15,219.38	\$100.78

The expenditures shown in this report do not include planting or harvesting the corn in 1914, nor the hay in 1916, nor water taxes for three years; neither do they include rebate on the tile replaced, main pump and motor replaced or the auxiliary pump.

PUMPING AND FLOODING

Pumping and Flooding

Beginning February 23, 1914, and continuing until May 1, the tract was being flooded. Within a week after flooding began, ten acres or more were under water, but the first pump which was installed

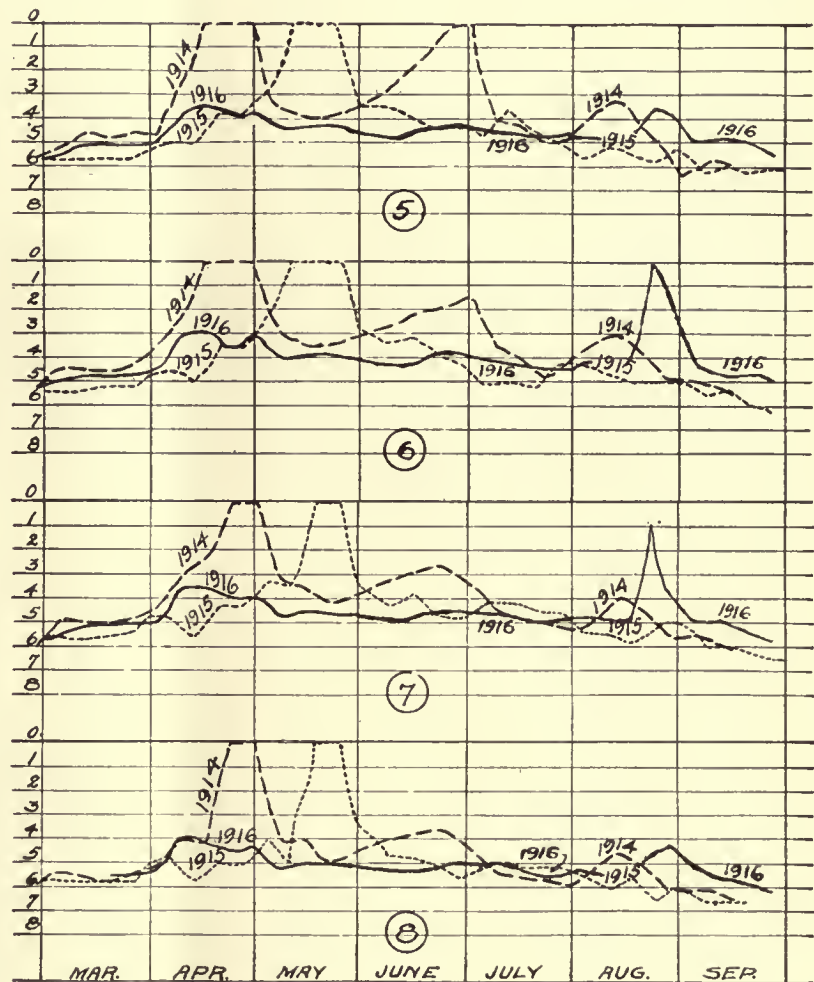


Fig. 7—Curves showing ground water table on Kearney Vineyard Experiment Drain.

proved too small and the ground water rose rapidly during the flooding. The flooding was then discontinued until after the auxiliary pump was installed. During the flooding as much land was kept under water as possible, so that the alkali would be carried downward rather than laterally. As much as forty acres were under water at one time. No estimates were obtained showing the amount of water used in flooding, except that the area flooded was kept under water from six inches to twelve inches deep for a period of at least one week. Measurements taken of the pump discharge show that there were approximately 97,580,000 gallons, or 300 acre-feet removed from the tract during the year. This is sufficient water to cover the entire 160 acres 1.88 feet deep. This does not include any discharge from the auxiliary pump.

Due to the flooding and the lack of proper pumping equipment, the ground water remained

high during the season. In 1915, with the larger equipment in place, the flooding was resumed in March and continued throughout April, covering about the same ground as before and for about the same period. The water used in flooding was not measured.

The pump discharge for each week during the seasons of 1915 and 1916 is shown in the following table:

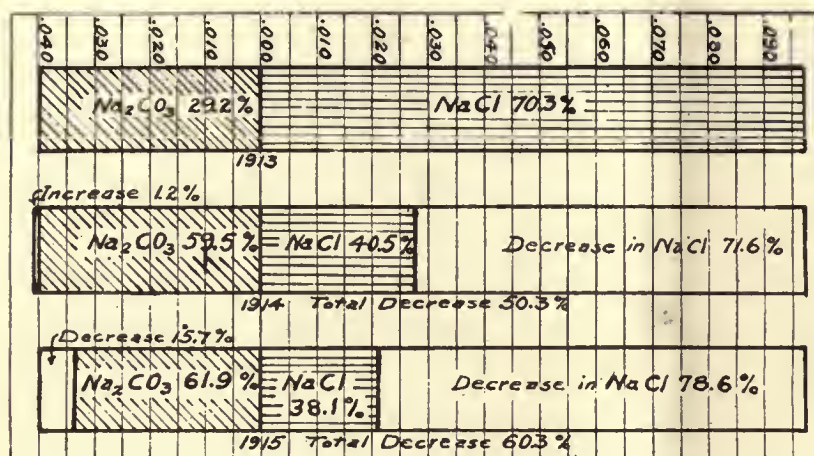


Fig. 8—Sodium salts in surface foot. Percentage of decrease and amount and percentage remaining after one and two years' drainage.

1915		1916	
Week ending—	Gals.	Week ending—	Gals.
Mar. 27....	5,480,000	Mar. 25....†
April 3....	6,790,000	April 1....	3,018,000
" 10....	8,780,000	" 8....†
" 17....	10,240,000	" 15....	7,616,000
" 24....	9,500,000*	" 23....	6,731,000
May 1....	9,500,000*	" 30....	9,900,000
" 8....	9,700,000	May 7....	8,904,000
" 15....	7,620,000	" 14....	7,968,000
" 22....	8,290,000	" 21....	7,907,000
" 29....	7,810,000	" 28....	7,308,000
June 5....	8,330,000	June 4....	6,552,000
" 12....	7,350,000	" 11....	6,216,000
" 19....	6,220,000	" 18....	6,266,000
" 26....	5,360,000	" 25....	7,140,000
July 3....	4,710,000	July 2....	6,200,000*
" 10....	4,870,000	" 9....	6,000,000*
" 17....	6,300,000	" 16....	5,800,000*
" 24....	5,390,000	" 23....	5,662,000
" 31....	4,440,000	" 30....	5,538,000
Aug. 7....	3,500,000	Aug. 6....	5,999,000
" 14....	2,630,000	" 13....	5,309,000
" 21....	1,630,000	" 20....	6,449,000
" 28....	420,000	" 27....	8,803,000
Sept. 4....	850,000	Sept. 3....	6,443,000
		" 10....	5,796,000
		" 17....	5,040,000
		" 24....	3,393,000
		Oct. 1....	1,026,000
Total ....145,710,000		Total ....162,984,000	

*Estimated.

†Pump not running.

1915 discharge equals 447.7 acre-feet, or 2.79 acre-feet over 160 acres.

1916 discharge equals 500.1 acre-feet, or 3.12 acre-feet over 160 acres.

During 1915 the pump was in actual operation 3,534 hours out of the total of 3,648 hours, or 96.8 per cent of the time between March 22 and August 20, discharging 144,440,000 gallons, or 1.52 cubic feet per second. During 1916 the pump was in actual

operation 3,921 hours out of a total of 4,056 hours, or 96.6 per cent of the time between April 10 and September 25, discharging 159,966,000 gallons, or 1.51 cubic feet per second.

In 1915 the maximum weekly discharge occurred during the week of April 17, when 10,240,000 gallons were pumped during 160 hours, or an equivalent of 2.38 cubic feet per second. During 1916 the maximum discharge occurred during the week ending April 30, when there were 9,900,000 gallons pumped during 165 hours, or 2.23 cubic feet per second.

The increased discharge in 1916 is due to the pumping season being lengthened by a late irrigation, in order to facilitate preparing the land for the 1917 crop.

Figures 6 and 7 show the depth to water from March to September inclusive for 1914, 1915 and 1916. These observations were made by weekly reading on test wells located midway between laterals and 450 feet from the main drain. Numbers 1 to 4 are located east of the main line and numbers 5 to 8 west of the main line. (See Fig. 2.)

The irregularities in the curves show the effect of flooding in the vicinity of the test well. The effect of the irrigation which the grain received in April, 1916, is shown quite plainly in all of the wells by the rise in the water table.

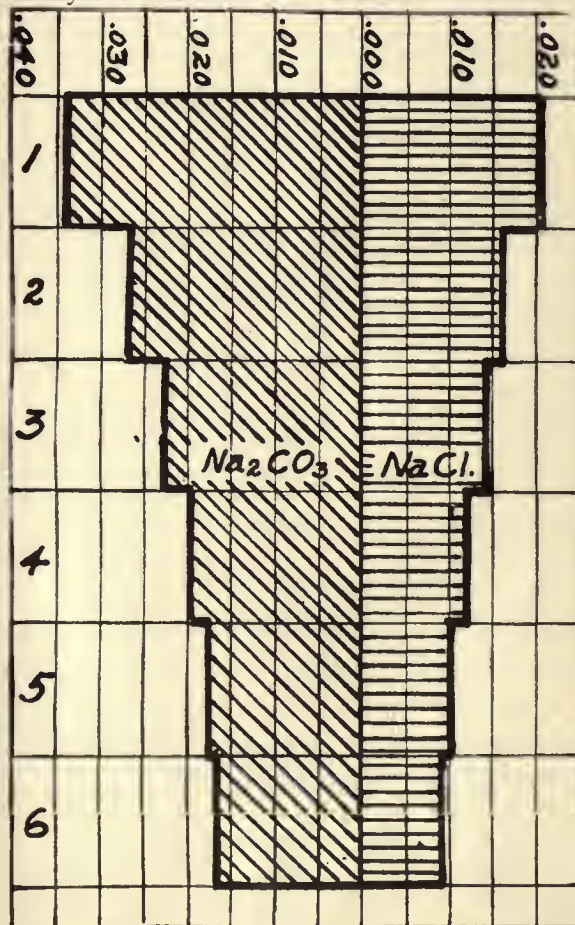


Fig. 9—Distribution of sodium salts through a six-foot soil column in 1915.

Taking May 22, 1916, as a representative date, the average of the eight wells on this tract shows the water table to be 4.8 feet below the surface, while on the same date, as shown by an average of eighteen wells, the water stood one foot higher on other parts of the Kearney Vineyard property. On



Fig. 10—Barley hay on east half of drained tract, May, 1916.

the same date the average depth to water was 2.6 feet in three wells on the tract immediately south of the drained area.

Removal of Alkali

The soil and alkali survey made in the summer of 1913 showed, as has been stated, that the surface foot, over a considerable portion of the tract, contained less than .20 per cent of combined salts, although there were areas where there was 3.0 per cent or over. The most alkaline portions were in the depressions, which have been described as being on either side of the ridge near the northwest corner of the tract. An area containing as high as 1.0 per cent was found covering about the center third of the east eighty acres.

In the fall of 1913 a series of analyses were made of soil samples taken from holes fifty feet apart on two parallel lines fifty feet apart running from the southeast to the northwest corner of the tract. The results of these analyses were compared with analyses made from soil samples taken from the same places in July, 1914, and July, 1915. In 1913 and 1914, samples were taken of each foot of soil from the surface to hardpan. During 1915 samples were taken for each foot from the surface to six feet.

Local variations in the alkali content of the soil make individual tests rather misleading and in order to reach any conclusions, all the tests in both lines were taken collectively. The following table gives the results of this method of handling the data:

Sodium Salts in Surface Foot

Year—	No. of tests	Per cent NaCl	Per cent Na_2CO_3	Total
1913	122	.0972	.0401	.1373
1914	119	.0276	.0406	.0682
1915	138	.0208	.0338	.0546

1914 decrease in NaCl, 71.6 per cent; increase

in Na_2CO_3 , 1.2 per cent; decrease in total alkali, 50.3 per cent.

1915 decrease in NaCl, 78.6 per cent; decrease in Na_2CO_3 , 15.7 per cent; decrease in total alkali, 60.3 per cent.

Fig. 8 shows the same results graphically. It will be noted from the above table that of the total, .1373 per cent of salt in the surface foot in 1913, 70.8 per cent was NaCl, or common salt, and 29.2 per cent Na_2CO_3 , or black alkali. In 1914 there was a decrease of 71.6 per cent in the NaCl and an increase of 1.2 per cent in the Na_2CO_3 , making a total decrease of 50.3 per cent. In 1915 the decrease in NaCl was 78.6 per cent of the amount present in 1913 and there was also a decrease of 15.7 per cent in the Na_2CO_3 for the same period, making a total decrease in two years of 60.3 per cent. The proportion of the two salts making up the remaining total of .0546 per cent of the soil had changed from a predominance of NaCl to a predominance of Na_2CO_3 .

The following table shows the distribution of sodium salts through soil column in 1915:

Year—	No. of tests	Per cent NaCl	Per cent Na_2CO_3	Per Cent Total
First foot	138	.0208	.0338	.0546
Second foot	138	.0161	.0263	.0424
Third foot	139	.0145	.0222	.0367
Fourth foot	138	.0125	.0196	.0321
Fifth foot	139	.0104	.0174	.0278
Sixth foot	137	.0039	.0163	.0256
Average	138	.0139	.0226	.0365

Fig. 9 shows graphically the same results as found in the above table. This diagram shows that both salts decrease quite regularly with the depth. Unfortunately, we have no data for making a similar diagram for 1913 and 1914, consequently it is not known whether the salts that have been removed from the surface foot have been redistributed through the six-foot soil column, or partially redistributed through this column and partially removed; or as is more likely the case, together with the salts originally between the second and sixth foot, they may have been partially removed and partially redistributed below six feet.

Assuming 92 pounds to be the weight of a cubic foot of soil, there would be 320,600 tons of soil in the surface foot on 160 acres. The soil analyses show that NaCl and Na_2CO_3 to the amount of .0827 per cent, or 265.13 tons, have been removed from the surface foot in two years. The drainage water analyses show that for the same period 285.4 tons of these salts have been removed from the tract.

At frequent intervals in 1914, and each week during 1915, samples of the drainage water were taken and analyzed for alkali. An average of these samples shows that in 1914, 151.5 tons of alkali were removed in the drainage water, of which 51.6 per cent was NaCl, 34.5 per cent Na_2CO_3 , and 13.9 per cent Na_2SO_4 . In 1915, 183 tons of alkali were removed, of which 36.6 per cent was NaCl, 48.4 per cent Na_2CO_3 , and 15 per cent Na_2SO_4 .

It will be noted that the water analyses made by the Division of Agricultural Chemistry, University of California, show the removal of considerable Na_2SO_4 , but the soil analyses made by the Division of Soil Chemistry and Bacteriology, University of California, do not indicate the presence of appreciable amounts in the soil. This is due to the method of analysis used by the Division of Soil Chemistry and Bacteriology, as no quantitative analyses were made for Na_2SO_4 unless a qualitative analysis gave a sulphate reaction.

It is interesting to note that water samples taken on the same dates in 1915 from the Houghton Canal and from a pumping plant about two miles distant on the Kearney Park Experiment Station tract, show an average alkali content as follows:

	parts per million
1. Kearney Vineyard experimental drain...	301.88
2. Houghton Canal	33.43
3. Kearney Park Experimental Station....	98.82

These figures would indicate that no great amount of alkali was added to the tract through the water used in flooding, and also that considerable more was removed in the drainage water than is found in the usual ground water.

The average alkali content for the tract has been materially reduced, as found after the 1915 tests, and is now much less than is usually considered detrimental to crops. Alkali tests made on areas where the 1916 crops were not satisfactory indicate that the alkali is not wholly responsible. There seems to be little doubt but that the physical condition of the soil is very poor in these spots and investigations are now under way to determine, if possible, a remedy for this condition.

Operations During 1916

During December, 1915, the west half of the tract was sown to oats. Owing to weather conditions it was not possible to plant the remainder of the tract until February, 1916, which was then sown to barley.

During the early part of April it became necessary to irrigate the barley planted on the east eighty acres. This operation took about one week and no more water was added until late in the season, this being done to facilitate the preparation of the land for alfalfa.

In 1916 one hundred and eighty tons of hay were obtained from the tract, an average of almost 1.2 tons per acre.

Summary

The tract of land chosen for this experiment was formerly a profitable vineyard, but because of a rising water table and the accompanying accumulation of alkali, passed from a vineyard through the stages of decline of an alfalfa and grain field to a poor pasture of foxtail and alkali weed. For two or three years previous to 1913 no crops were grown.

Preliminary investigations indicated the presence of alkali in dangerous quantities over a con-

siderable portion of the tract. At certain times of the year the water table was less than two feet from the surface and during most of the growing season was dangerously high.

The installation of the drainage system in 1913 was the first step toward reclamation. Shortly after operations were started in 1914, several errors in design were discovered, the principal ones being a too small and poorly-designed pumping equipment and too small carrying capacity of the main drain. These have been remedied. Aside from these changes made during the spring and summer of 1914, it became apparent that fewer and less expensive silt wells would have served the purpose and the canal crossings could have been omitted entirely.

The reclamation of this tract has involved the expenditure of \$100 per acre, which is a large expense, but it must be remembered that the entire expenses incidental to putting this land into an irrigable condition and the eradication of Bermuda grass, amounting to approximately \$20 per acre, would have been necessary under any circumstances and cannot be properly chargeable to drainage; in many cases of reclamation it will not be necessary. The duplicate expenses for pump and tile can be eliminated from future undertakings of this character, and this, together with changes in design that will favor economy in construction, will reduce the first cost by an additional \$20 per acre, making a total possible reduction of about \$40 per acre.

From measurements taken of the pump discharge, it is evident that drainage systems under similar conditions should be designed to remove at least one cubic foot per second for each 100 acres, especially where the drained tract is entirely surrounded by undrained land.

Indications are that the lateral drains might have been placed 400 feet apart. It would have been better had the lateral tile lines been placed six and one-half or seven feet deep, instead of five and three-quarters feet. The hardpan, which was known to



Fig. 11—Oat hay on west half of drained tract, May, 1916.

exist, has not proved to be a material hindrance to the movement of water.

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NEWS NOTES FROM IRRIGATION PROJECTS OF THE COUNTRY

CALIFORNIA

The conflicting claims of the Modesto and Turlock irrigation districts and the Yosemite Power Company as to water rights on the Tuolumne river have been settled through an agreement just reached between the directors of the two districts and representatives of the power company, the agreement placing the recognized right of the power company to 66 second feet of the natural flow of the stream. The power company has hitherto claimed right to 300 second feet. On the basis of this agreement the suit by the district against the power company which has been pending several months in the superior court will be ended by entry of judgment entitling the power company to 66 second feet.

COLORADO

The Henkins Reservoir and Irrigation project on Mud creek, southwest of Lamar, is to be greatly enlarged and improved and will be made to irrigate several thousand acres of fine land outside of the Henkins ranch.

Mead and Longmont county farmers are planning the building of a \$30,000 reservoir to be constructed at the foot of Longs Peak, that will irrigate 1,000 acres.

OREGON

Believing that work may soon be started by the government on the Crane Prairie Reservoir, one of the largest water storage systems ever planned in central Oregon, Fred N. Wallace, engineer for the Tumalo irrigation project, recently completed a survey for a three-mile canal to connect the Tumalo canal with the proposed irrigation system, which would make possible the watering of thousands of acres of land in Central Oregon.

Through changes in the irrigation district laws the question has arisen relative to the Ochoco irrigation district bond issue, as to whether the district under the new law must take over certain water rights under the old law, and for this reason the decision of the State Bonding Board as to the certification of \$900,000 worth of the district bonds may be delayed for a short time. If it is found that the water rights must be taken over it probably will require an extra expenditure of about \$150,000 on the part of the district, and this will prevent the state certifying to the bond issue until after another election is held.

UTAH

A trust deed from Utah Lake Irrigation Company to William L. Biersach, trustee, to secure a loan of \$125,000, has been filed with the county recorder. The indebtedness will be in the form of \$5,000 and \$1,000

notes bearing 8 per cent interest, payable quarterly. The deed conveys to the trustee many tracts of land in Salt Lake and Utah counties and notes given by water users to the company.

Ruben S. Collett of Roosevelt, has made application to the state engineer for the use of 843 acre feet of water to irrigate 840 acres of ground. It is Mr. Collett's intention to take the water from an unnamed draw in Uinta county by means of a ditch 1,000 feet long to a storage basin.

N. J. Christensen of Ferron, has filed an application with the state engineer for the use of thirty second-feet of water from Ferron creek for the purpose of developing 275 horsepower. A concrete dam eight feet in height and fifty feet long will be constructed and the wheel will be under a head of 100 feet. The water will be conducted to the turbine by two twenty-four inch pipes. The water will be returned to the creek above all existing irrigation ditches.

WASHINGTON

Regardless of what the national council of defense decides regarding the appropriation of \$2,000,000 to complete the irrigation system on the Yakima reservation as a war measure the Indian reclamation department is preparing to enlarge the present canal and put 10,000 more acres under cultivation for the crop season of 1918.

Since a part of the canal is in a new location, excavation work is to begin at once, and Superintendent L. M. Holt is this week installing a drag-line excavator for cutting two miles of new canal, approximately paralleling the present main canal, but on higher ground.

At the end of the present irrigation season the remainder of the main canal is to be cut to a larger carrying capacity and new laterals excavated, carrying water to land not now under cultivation. Superintendent Holt has received authority to buy another excavator, making three, which will be put to use in cutting canals or drainage ditches. With no further appropriations available than funds now on hand he will be able to furnish water to 10,000 acres additional for the crop season of 1918.

The reclamation service announces the completion of the first unit of the Grandview pumping plant, and that no work will be done upon the other units until fall on account of the inability to get delivery on the electrical machinery. The first pumping unit is hydraulic turbine, lifting 16 second-feet, with capacity for irrigating 1,600 acres. About 600 to 800 acres of this is in crop this year. The main canals are concrete lined and the distributing system for the whole district has been completed.

Articles of incorporation have been filed by the Water Motor Irrigation Company, with a capital stock of \$300,000. The office of the company is located at Seattle. The incorporators are W. I. Peary, H. H. Holbrook and Olga Perry.

MONTANA

The West Park Irrigation Company with main offices in Red Lodge, authorized capital \$15,000, all of which is subscribed, has filed articles of incorporation. The incorporators are Peter Lemley, Arthur Henlund and N. Nieme of Red Lodge.

About 60 farmers, owning approximately 10,000 acres of land in the valley of the Tongue river near Miles City, have brought suit against W. B. Jordan, owner of a big irrigation ditch, to compel him to sell water to them for irrigating their crops. When the ditch was built the farmers refused to buy the right of way, claiming the price was exorbitant.

Work on the Flatwillow irrigation project is to be pushed rapidly to completion, according to an announcement made following a recent meeting of the stockholders of the Fergus County Land and Irrigation Company. The Flatwillow project embraces about 8,000 acres of Carey act lands segregated for use of this company under Carey Act withdrawal No. 21 in eastern Fergus county, a few miles southeast of Grass Range, and a shorter distance south of Winnett.

Work on the project of the Thompson Falls Development Company, consisting of 2,000 acres lying just east of Thompson Falls is rapidly nearing completion. The construction includes 2,500 feet of flume; 3,600 feet of 12-inch pipe line and about four miles of laterals. The main ditch is already built.

NEBRASKA

The Secretary of the Interior has authorized the Reclamation Service to award contract to J. E. Hilton of Lingle, Wyo., for earthwork on Fort Laramie Canal Stations 3260 to 3563-60 Fort Laramie Unit, North Platte Irrigation Project, Nebraska. The work involves approximately 336,500 cubic yards of excavation and is located near the Bridgeport-Guernsey line of the C. B. & Q. railway. Rapid progress is being made in the construction of this canal, which when completed will irrigate 100,000 acres in Wyoming and Nebraska on the south side of the North Platte river. It is anticipated that the system will be ready for operation in 1918, and in the fall of that year a large area of government land will be opened to entry. The south canal system diverts water from the Whalen dam in Wyoming, and will be more than 100 miles long.

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MISCELLANEOUS

A recent fire destroyed the Orange County irrigation pumping plant situated on the Newton county line eight miles from Orange, Texas. This plant, which was a valuable one, was used to supply water to about 10,000 acres of rice lands. The ground is now being cleared with the view of installing a new plant at the earliest moment possible.

The State Engineer of South Dakota, has made final arrangements with the engineers of the United States Reclamation Service at Denver, for the completion of the survey of the Angostura project in Fall River and Custer counties. The first part of the investigation will begin at the dam site, as the dam will be approximately one-third the cost of the entire project, and much depends upon its feasibility.

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Thirty-Second Year

THE IRRIGATION AGE

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No. 11

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With which is Merged

The National Land and Irrigation Journal

MODERN IRRIGATION

THE IRRIGATION ERA

ARID AMERICA

THE WATER USERS' BULLETIN

THE DRAINAGE JOURNAL

MID-WEST

THE FARM HERALD

THE IRRIGATOR

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Official organ Federation of Tree Growing Clubs of America. D. H. Anderson, Secretary.

The Executive Committee of the National Federation of Water Users' Association has taken action whereby THE IRRIGATION AGE is created the official organ of this vast organization, representing 1,000,000 persons on the government irrigation projects.

Irrigation Age Will Enter New Field

For more than thirty-two years the editor of this publication has watched the progress of irrigation affairs. During that term he has noted with interest an almost endless procession of so-called irrigation journals as they tried their wings on the financial breezes, only to descend to oblivion with a dull thud when the sustaining bank-book was withdrawn.

While nearing the end of his thirty-second year in the editorial chair, the publisher of the AGE admits that the term "vicarious" is not without special significance in connection with an irrigation journal. The subsistence is almost "precarious" at times.

But notwithstanding the vicissitudes of the Irrigation Age, due perhaps in great measure to its honest expression of opinion regardless of the wishes of reclamation officials or gain-seeking individuals, it has continued its regular appearance at each succeeding month until today it can look back with satisfaction at the record. The editor has the pleasure of knowing that his efforts have not been without fruit, either in friends or enemies.

And while the AGE has met its obstacles and solved its problems, irrigation has been undergoing a mighty change. In this thirty-two years of transition, irrigation has been beset by difficulties and impediments. It has suffered from lack of understanding both by those who built and those who bought. It has been exploited for the especial bene-

fit of the promotor's pocket-book. It has been legislated at both too frequently and to meagerly. It has been organized, disorganized and reorganized.

There has been a deadly parallel between irrigation and the IRRIGATION AGE.

With a record of thirty-two years devoted to the cause, the editor feels that his publication has still a major part to play in further development of this great industry. It is confidently hoped that the AGE may continue its work along lines that shall be profitable and acceptable to its thousands of readers.

Looking into the vista of years that will write the future history of irrigation in the United States, the editor forecasts a period of organization and evolution. Confronted by numberless problems of administration, water users must, for their own protection, form themselves into an association through which they may act in unison for their mutual profit.

With the formation of organizations will come the demand for cooperative control of irrigation projects. In this direction are innumerable problems that must be solved if there is to be financial success.

It is toward this goal that the AGE will direct its future activities. Plans, now in the making, contemplate the creation of a great water users' convention to which the representatives of all local associations will be sent. Upon the deliberations of this gathering will depend much. It will have the power to become a dominating force in irriga-

tion affairs, serving its constituents in matters of legislation and such other negotiations as may be essential to the welfare of irrigation work.

It is the wish of the editor that the IRRIGATION AGE may become the mouthpiece for the water users associations and that its pages may aid in the discussion of all those problems incident to the future organization and evolution of irrigation.

**Water
Users
Should
Organize**

When President Wilson, in his memorable note to Pope Benedict, laid down the broad principle that government must hereafter be responsible to its people to enjoy the confidence and respect of other nations, he uttered a truth that may well find application in the internal, the economic affairs of our own country.

As we watch the course of events in Europe, hoping for that time when oligarchies shall tremble under the commanding voices of their peoples—and peace shall have been brought to the war-sick world—let us turn a contemplative eye upon our own government, that we may cast out those irresponsible and unreliable factors in our own body politic. And even as the peoples of Europe must plan their emancipation by revising, reassembling and reconstructing their governments, so should we devise means to rebuild or reorganize governmental functions along lines that shall bring to us the fruits of real democracy.

The history of reclamation work as handled by our federal bureau has been a history of arrogance, incompetency and futility. Born of vast conception and mighty potency, the reclamation service became a slough for high-handed bureaucracy, arbitrary in its decisions and strutful in its bearing. Its directing minds became so conscious of authority that they became unconscious of its objects.

The early record of our reclamation work finds a direct parallel in the militarism of Europe; its own avarice and glorification overshadowed the reasons of its being. It victimized those whom it aimed to benefit.

Happily, the arrogance and inefficiency that characterized federal irrigation work in this country are passing into a deserved oblivion. Indeed, the more recent utterances and acts of those officials who are charged with the responsibility for this work exhibit a clarity of vision and an earnestness of purpose that augurs well for the future.

Nevertheless this regeneration in the department depends upon the continuance in office of those officials who were instrumental in abolishing the bureaucratic tendencies of former days. If we were assured that Secretary Lane would hold office in-

definitely, we might well lay aside all fears for the future conduct of the reclamation service. Without that assurance we must prepare to fortify the present situation against prospective political changes.

Obviously, the solution of the future problem lies in organization. Water users, those who are most vitally interested in irrigation work, whether it be Federal, Carey Act, or individual enterprise, must band together for the protection of their rights. Not only should each local association become stronger in its membership, but the confederation of water users should combine all in one powerful and effective organization.

Under the present management of the reclamation service the plaint or protest of a few water users may receive just and honest consideration. But will these gracious times continue?

Strength of organization and a unity of purpose that shall combine the voices of tens of thousands, are the surest means to prevent abuses in the reclamation service. Let the people rule. Let those who have invested their time and their labor and their money in irrigated tracts demand their rights in a form that shall sound like votes to a recalcitrant Washington. There need then be no fear of a return to feudalism in the reclamation service.

**Europe's
Farms
Badly
Depleted**

Peace will come: then what? How will Europe feed its people? Can they turn, in a flash, from the musket to the plow at the moment hostilities cease? Will they be able to compete in the world's markets against the American farmer?

Millions of men are scattered along the battle lines thousands of miles from their homes and occupations. Cities, towns and villages have been leveled to the ground. Millions of acres of the rich, arable lands of Europe have been bled white during the three years of war. Crops, heavy crops, and still heavier crops, have been the battle slogans.

Every possible ounce of vitalizing power has been drawn from the soil, while little, if any, nourishment has been returned. The export of chemical manures ceased months ago, because stocks were low in Europe. The land has suffered from deterioration. Depletion has proceeded with relentless vigor.

Europe's farm land must be regerminated and revived before it can again produce even ordinary crops. Chemical farm foods must be again spread plentifully over the continent or the lands will become as arid as the Gobi desert. It must rest, and while resting must regenerate the pro-creative energy and growing force of the soil. Years must

pass for the rehabilitation and adjustment of the working element. It will fructify only in the course of time.

Shipping will be taxed to the last ton in transporting the disbanded military organization and the engines of war. Commerce must be subservient to the needs. Even the avenues of transport must undergo rejuvenation of equipment before they shall be ready for unmilitary uses.

Then what about the food question during this dismemberment of Europe's human fighting machine?

Without the aid of the American farmer during the past three years, half of Europe might have starved. With her agriculture disorganized, her soil depleted and millions of her men incapacitated for farm work it may well be predicted that for at least two years after peace has been proclaimed, Europe will be able to raise but a small proportion of her necessary and adequate food supplies.

Conditions such as these will mean that the American farmer will live in prosperous times, evidenced by solid dollars and cents. During this period of European agricultural reorganization it will be profitable for him to increase his acreage and plan to reap a maximum benefit from a world market that will surely maintain prices far above the normal.

Adieu
Chicago:
Hurrah for
Salt Lake

With this, probably the last issue of the IRRIGATION AGE to be edited at this location, we bid a fond adieu to our old publication office. There is a note of regret at the change; for many a pleasant memory hovers about the old place, and many a cordial friend lives in this great hive of industry known as Chicago.

But what of Salt Lake City?

There is a thrill, a quickening of the pulse even in the name. It stands for enterprise, progress, endeavor. It put the try in triumph. It is a city wherein lie all the elements of greatness. No man knows of its future, but every citizen believes in it.

Salt Lake City will be indissolubly linked with the future of irrigation. The logical center for conferences, it is preparing to promote and encourage those activities that are so vital to the work.

In advancing its organization to this new location the IRRIGATION AGE is confident that it will grow in value to the irrigation world. Our present offices, 30 North Dearborn street, Chicago, will be maintained until May 1, 1918, and possibly indefinitely, but as branch offices only. After October 15, 1917, all mail should be addressed to THE IRRIGATION AGE, Salt Lake City.

Prepare to Operate Federal Project

Attention of readers is called to the letter, appearing in this issue of the AGE, from Project Manager Pyle to the water users in the Uncompahgre district of Colorado. To those who have followed developments in this project the letter will prove of interest as a general exposition of the problems that will confront water users upon assuming control of operation and management.

In passing it seems pertinent to remark that much credit belongs to those officials who are responsible for the initial steps toward cooperative control. The subject has been approached in a careful, businesslike way that assures eventual success in the undertaking. Especial commendation attaches to the work of Mr. F. D. Catlin, of Montrose, whose legal advice has been of inestimable value and whose active participation has brought intelligent and constructive results.

Believing that our readers are interested in the conditions under which water users assume control, and the various steps in the transfer of authorities, the Irrigation Age will continue to present, from month to month, such facts and information as seem worthy of publication.

Silos Conserve Feed

Erecting a silo is not so spectacular as shelling a trench; but is certain to have an important part in winning the war. We must conserve food or Uncle Sam cannot supply his hungry neighbors. Here the silo plays its part in world affairs. It is the greatest feed saver known to farming.

An acre of corn fodder put into the silo has more feeding value than an acre of corn whose stalks have been stripped of its ears and fed with the meal made from the dry corn. There are several reasons for this. One is that in putting corn into the silo none of it is wasted. The whole corn plant, except the roots, goes in and when it comes out it is so palatable that the cattle, horses and sheep just cannot leave it alone until the last vestige has disappeared.

Another economy in the use of the silo results from corn being stored at a time when it contains the greatest amount of nutrients per acre. Then, after the fodder is in the silo, it goes right on getting better. It becomes even more palatable than the corn was before being ensiled, tasting so good in the ration that the cow or steer does not mind particularly if some of the other feeds are somewhat dulling to the appetite.

In the labor saved lies further silo economy, which is of great importance now. It takes no more labor to put an acre of corn in the silo than to shock, husk and shred it; but the product is more valuable.

Rats and mice cannot eat the corn that is in the silo, nor wind and rain decrease its feeding value.

STEPS TOWARD PROJECT CONTROL

Report and Suggestions by Project Manager Fred D. Pyle to Members of Uncompahgre Water Users Association, Colorado.

Under recent date Mr. Pyle submitted to Dr. A. C. McClanahan, president of the Uncompahgre Water Users Association, the following letter, which, because of its detailed explanations and its general comprehensiveness, may find ready application in other districts. In the course of his communication he gives a clear discussion of many problems connected with the taking over of the responsibilities and authorities of project operation.

I believe it advisable for the Association to take over the operation and maintenance of the entire project, as they will then have everything in their control and there will be no possible points of friction with Government agents as to water delivery. In order for the Water Users to adequately operate the distributing system, it will be necessary for them to have a complete organization with a competent manager, consequently, the addition of the Gunnison Tunnel and South Canal will not materially increase their overhead expense.

I believe that the government should complete the work in the Gunnison Tunnel and the enlargement of the California Mesa lateral system, both of which can probably be completed before the 1918 irrigation season, provided that sufficient mechanics, laborers and teams can be obtained to keep the camps full handed. Any remaining work can be handled by the association as operation and maintenance work.

Mr. Newell in his book on Irrigation Management says:

"The irrigation project built by a corporation or by the Government is destined ultimately to go into the hands of the water users. The sooner this transfer is made, the better for all concerned if the water users will accept the full responsibility and employ men of large experience. The manager who is thus acting as agent of the original builders must look forward to the time when the water users themselves will exercise more direct control and make such provision as may be necessary towards aiding the water users in appreciating the responsibilities which they should assume.

"The difficulties which have been experienced in the past in the transfer of responsible control of large irrigation works to the irrigators have grown out of ignorance and lack of development of what may be called a community conscience. An irrigation project completed under the terms of the Reclamation Act, Carey Act, or District Law, is highly complicated and an extremely expensive piece of machinery, comparable to a railroad system or a large manufacturing establishment. If we imagine a large railroad or mill, furnishing occupation to thousands of men, transferred to the control of these men to be operated by them, we have about the condition which exists when a large irrigation project is turned over to the landowners. In some cases there has resulted confusion or even disaster until the entire body of men concerned have been educated through their losses to the observance of certain well-established principles. The problem is to try

to avoid these losses and the expensive education which in the past has seemed necessary, by adopting certain precautions and anticipating the dangers which arise from the change.

"This attitude of indifference to the observations of the rules and regulations which have been found vital in older irrigated areas makes the problem of proper control of the work extremely difficult and adds to the dangers of transfer of this control to the entire body of water users. Without a strong central authority no one is willing to come forward to advocate the punishment of the influential neighbor even if he is a notorious water thief. The whole system falls into confusion until through the accumulated losses the community is awakened to its danger."

Your association is now in as good a condition as it will ever be to take over the operation and maintenance of the project and on account of the advantageous conditions contained in the Secretary's letter of May 26th there should be no doubt about the proposition carrying when put up to the Water Users. However, a publicity campaign should be carried on so that the community conscience may be awakened to its needs and necessities in time to avoid possible mistakes.

The present organization is not the best for taking over the project. While the proxy system and accumulative vote may be according to the State law and proper for certain classes of organizations, it is a very vicious method and is certain to lead to trouble in the operation of an irrigation system of this magnitude, where the manipulation of the proxies will be used for the selfish benefit of individuals rather than for the benefit of the community. To avoid this your association might be re-organized on the co-operative basis or as an irrigation district.

One of the things which must be carefully considered in the future operation of the project is a proper balance between efficiency and economy. Good service must be the first consideration and every possible effort should be made to maintain good service in the most economical manner. The saving of a few thousand dollars expense may easily result in the loss of crops to the value of \$100,000.

Your executive organization will consist of a Board of Directors, from which will be selected a President, Vice-President and possibly a Secretary and Treasurer.

This Board should attend to all matters of policy, such as rules and regulations concerning collections, methods of water delivery, financing of

the work, organization of operating forces, grievances, winter water, hours of work, salaries, etc.

The Board will select a manager or superintendent, who should have charge of the operation and maintenance of the project, and who should also have charge of all equipment and buildings and be responsible for all expenditures. All unusual expenditures, however, should be approved in advance by the Board of Directors. The Superintendent's organization should consist of an Assistant Manager, who will spend practically all of his time in the field, two Water Masters, a Hydrographer and Ditchrider, Headgate Tenders, laborers and teams as required. The Superintendent should be given complete charge of his organization and be held responsible for the results accomplished. The operation of this project is no place for petty politics and all the evils that follow.

A man will be required to handle routine office work, purchases, storehouse, etc.; another to handle the collections and disbursements; another to handle the bookkeeping. Stenographic help will also be required and at times special help to handle collec-

It will be necessary to acquire certain equipment, either by purchase from the Government or by purchase from private firms, as the occasion arises. These may include small tools, slips, scrapers, plows, concrete plants, pile drivers, camp equipment, automobiles, office furniture, office equipment, engineering instruments, etc., also miscellaneous supplies, such as lumber, nails, sacks, cement, reinforcing steel, etc.

It will be necessary to acquire quarters, especially for the headquarters office. This may be done by taking over the Government quarters or by purchasing or renting quarters and is a matter that should receive serious consideration.

The organization can be financed on a strictly cash basis by collecting a portion of the charges December 1st, and the remainder before water is delivered, or on a part credit part cash basis, borrowing money from the banks until the collections are made prior to delivery of water, or on a credit basis, borrowing money and collecting at the end of the season to repay it. The part credit part cash proposition is probably the most feasible for the



One of the Pump Stations on Patterson Irrigated Farms, Patterson, California. There Are Eight of These of Varying Capacity on This Project.

tions. The above mentioned men may report to the Superintendent or to the President of the association. They should be properly qualified for their positions. It is possible for the Secretary of the Board to act as office man and for the Treasurer to act as Field Agent. However, there are some drawbacks to this arrangement on account of the difficulties encountered if they are not competent in removing them from office if they occupy positions as Directors of the organization.

In addition to the above, legal advice will be required from time to time and if your Superintendent is not an Engineer, engineering advice will be needed as the occasion arises.

The collection and disbursement vouchers should be audited annually by a regular auditing company.

Among the things that must be considered in taking over the control of the project are equipment and quarters, to be acquired from the Government or otherwise, the matter of financing the undertaking, the collecting of operation and maintenance charges, method of accounting to be used, method of water delivery, etc.

best interests of the Water Users, because the Association, when properly conducted, will have better credit facilities and will be able to borrow money at a lower rate of interest than can the individual farmer, especially those who have to borrow.

It is probable that the banks would carefully examine the legal status of the Association before loaning money to it. This would be especially true if the Association has to go outside of the Valley for money.

Rules and regulations will have to be prepared for enforcing collections and a regular routine determined upon for disposing of these cases where payment is not forthcoming. It will probably be necessary to carry some cases to the Courts in order to establish the rights of the Association.

A system of accounting will have to be established, including Time Books, Time Checks, Pay Rolls, Vouchers, Accountability of funds and of equipment, method of purchasing, notices of charges due, receipts for money paid, etc. Certain men who are entrusted with funds will have to be bonded. Cost reports will have to be made and annual reports to the stockholders.

The following are a few of the many points that will have to be considered in making rules and regulations regarding the delivery of water; winter water; waste water; regulation of turnouts by water users; fences, flumes, bridges, etc., across canals; continuous flow versus rotation; collection of operation and maintenance charges on the acre feet basis versus acres irrigated.

It must be kept in mind that the measurement of water to farmers is just as necessary as the weighing of groceries to a customer of a grocery store; that the only practical way to measure water is by use of wiers and spill boxes, or by gaging stations and the use of current meters. The last method is the only practical one for use on canal and river stations. It is necessary for the operation organization to know just how much water is available at any time and how much is being used or is required by the various canals. This information is of particular value in making the proper distribution of water during periods when all available water is being used.

You will find that the demand of the actual water user will be for better service, which will require careful measurement and accurate records of the amount delivered at all turnouts.

The principal difficulties which will be encountered in operating the project are alkali action on concrete; sliding banks and sidehills; gravel and drift in canal; headgates on river; flood water in river; and floods on cross drainage channels; weeds and brush on canal banks and the general tendency for the capacity to decrease in all canals unless kept thoroughly cleaned.

The principal benefits derived from taking over the management of the project in accordance with

the Secretary's letter are deferment of five years of payments on about \$7,000,000 which represents to the project farmers a saving at 6% of about \$2,367,400. The present value of a \$60 water right on the 6% basis, assuming charges to commence December 1, 1917, under the terms of the Reclamation Extension act, for land subscribed before August 3, 1914, is \$33.11, that is \$33.11 placed at 6% on December 1, 1917, would meet all payments. The present value of the same water right, if advantage is taken of the Secretary's letter, is \$24.69, or \$24.69 placed at 6% interest on December 1, 1917, would meet all construction payments.

Another advantage is that the Water Users' Association will have more authority over the delivery of water and will be able to adjust many questions on the project instead of referring them to Denver or Washington for adjustment.

I would recommend that all who are interested in the operation and maintenance of the project, either as water users or as officials, secure a copy of Newell's Irrigation Management. Mr. McCrimmon at Montrose will be able to supply a limited number of these books.

I would also recommend that the association employ an engineer to give them advice as to details of the above suggestions and other matters which may need consideration.

I wish the Directors to understand that the above has not been written for the purpose of discouraging the water users from taking over the project, but to suggest some of the many things they will have to contend with and if they are able to profit in the least with this advice, I will feel amply repaid for the time and effort required to prepare it.

WESTERN CANADA IRRIGATORS MEET

Eleventh Annual Convention Held at Maple Creek, Saskatchewan

By HERBERT VANDERHOOF

Maple Creek, Saskatchewan, once famous as a ranching centre, and still retaining much of the atmosphere of the good old days before the barbed wire era, has just been entertaining the Western Canada Irrigation Association at its Eleventh Annual Convention. This, by the way, is the first time the Convention has been held in Saskatchewan, and it was particularly appropriate that Maple Creek should have been selected as the point of meeting and that the Honorable W. R. Motherwell, Minister of Agriculture for the Province of Saskatchewan, should have presided over the deliberations. Maple Creek is the centre of Saskatchewan's irrigation enterprises, which are on a much larger scale than most people, even residents of that Province, appreciate. A large number of streams flow down from the Cypress Hills, and back in the '90's the ranchers began diverting the water from those streams for hay and pasture purpose. It is recorded that the first ditches at Maple Creek were dug in 1896, although the first irrigation license was not issued until 1900. About the same time irrigation began to be employed at Bear Creek and Piapot

Creek. From these beginnings an irrigation district with 190 schemes has been developed. The irrigation is employed mainly for pasture and for growing crops of hay and other fodder. Irrigation and dry farming are practised side by side and the crop marketed at Maple Creek in 1916 had a valuation of \$2,500,000.

President Appeals for Production.

Honorable W. R. Motherwell, Minister of Agriculture of Saskatchewan, and President of the Association, although in ill health, attended and presided over the first two days of the convention. While not an irrigator himself, Mr. Motherwell has had many years' experience as a dry farmer, and he remarked that he had discovered that the profession of the irrigator and dry farmer were the same, namely, providing moisture for the crops. Instead of being two distinct professions they were but two branches of the same profession. Mr. Motherwell expressed the opinion that the ideal farm was a farm partly irrigated and partly non-irrigated. On the irrigated section he would raise his pasture crops, hay, clover, alfalfa, root crops, small fruits, trees

and gardens, and on the non-irrigated section with dry farming methods he would raise his grain crops. As it happens this is actually the condition that is found throughout a large part of the irrigated areas of Saskatchewan and Alberta.

Foreshadows New Legislation.

The matter of new legislation which would enable districts in Saskatchewan to undertake irrigation enterprises on the same basis as in Alberta came up for some discussion, and Mr. Motherwell assured the Convention that any need for new legislation would be sympathetically considered by the Government. It was indicated that the legislation to create irrigation districts would probably be similar to the legislation in Saskatchewan for drainage purposes, by which the community may organize itself and incur liabilities chargeable to the lands affected.

Experts Discuss Agriculture.

The programme included the names of some of the best known agricultural experts in the West, such as Prof. J. Bracken, of the Field Husbandry Department, University of Saskatchewan; Don H. Bark, Chief of Irrigation Investigation Division of the Canadian Pacific Railway; Prof. W. H. Fairfield, Supt. Dominion Experimental Station, Lethbridge; F. H. Auld, Deputy Minister of Agriculture for Saskatchewan; F. M. Logan, Assistant Dairy Commissioner, Regina; James Johnson, of Nelson, B. C.; Prof. L. S. Klinck, Dean of the Faculty of Agriculture of the University of British Columbia; G. R. Marnoch, President of the Lethbridge Board of Trade; A. S. Dawson, Chief Engineer of the Canadian Pacific Railway, Department of Natural Resources; Archibald Mitchell of the Mitchell Nursery Company; A. A. Dowell, Animal Husbandry Instructor of the University of Alberta; F. B. Linfield, Director Montana Agricultural Experiment Station at Bozeman, Montana, and others. The first three named—Messrs. Bracken, Bark and Fairfield, devoted themselves entirely to a discussion of alfalfa raising, Mr. Bracken dealing with alfalfa under dry land conditions and Messrs. Bark and Fairfield discussing it under irrigation conditions. Alfalfa is essentially an irrigated crop, which is best illustrated by Prof. Fairchild's remark that the Lethbridge irrigation district is now the principal alfalfa centre of Canada, with about 15,000 acres devoted to this crop. It was grown originally for export, but has become the basis of an important live stock and dairy industry.

Fish an Irrigation Product.

The feasibility of increasing the fish supply of the country by employing irrigation reservoirs for that purpose was discussed in a very interesting paper by Prof. E. E. Prince, Dominion Fisheries Commissioner, of Ottawa. Prof. Prince pointed out that the conditions existing in irrigation reservoirs, and even in irrigation canals, were particularly favorable to the production of great quantities of fish. He discussed the various kinds of fish most suitable for this purpose, and seemed to favor the Yellow Perch as the most desirable species. Arguments in favor of encouraging fish production throughout the irrigation districts are self evident. Not only would the fish become a valuable and inexpensive item of food

on the farmer's table, but the sport incidental to the industry would add to the attractiveness of farm life. Prof. Prince assured the Convention of the most sympathetic co-operation from the Fisheries Department along any lines found to be practicable.

Reservoirs in Cypress Hills.

One of the serious problems which confronts the irrigators in the Cypress Hills district is found in the fact that although there is a heavy spring flow of water in the streams coming out of the hills, this flow has largely disappeared by the time it is required for irrigation purposes. The only means of meeting this situation is found in the creation of reservoirs which will hold the surplus water back until such time as it may be required. F. H. Peters, Commissioner of Irrigation of the Department of the Interior, delivered an interesting paper on this subject. His department has already made exhaustive surveys of the Cypress Hills watershed, and he was able to present to the Convention estimates of the cost of reservoirs that would materially increase the supply of water available in the Cypress Hills district. It was not proposed that this work should be proceeded with immediately, as there was a general recognition on the part of the Convention that many necessary developments must wait until after the war, but the surveys which have been made and the estimates which have been presented will doubtless constitute the basis of extensive irrigation enterprises within the next few years.

Linked closely with Mr. Peter's discussion of reservoirs was an address by E. H. Finlayson, District Inspector of Forest Reservoirs, on the Cypress Hills Forest Reserve. The relationship of forests to water supply is pretty generally understood. Mr. Finlayson brought it home with particular emphasis to the irrigators of the Maple Creek district. For their water supply they are absolutely dependent upon the forest areas in the Cypress Hills, and he appealed to them especially for co-operation in protecting these areas from destruction by fire, which is the greatest enemy not only to the forest reserve, but to the agricultural development of the country. With the various reserves destroyed, not only would the supply of irrigation water be reduced, but climatic conditions would be induced which would be a menace to the agricultural development of the Province.

International Irrigation Convention.

A. S. Dawson, Chief Engineer of the Department of Natural Resources of the Canadian Pacific Railway, outlined in a short address the main features of the International Irrigation Congress at El Paso, Texas, last year, which Mr. Dawson attended, in company with S. G. Porter, B. S. Stockton and Robert J. C. Stead, all delegates from Southern Alberta. About 400 delegates attended the convention and the Canadian representatives were given places on the programme. Canada's importance as an irrigation country was further recognized by re-electing Mr. J. S. Dennis, Chief Commissioner of Colonization and Development of the Canadian Pacific Railway, to the position of Vice-President of the Association, and by electing the speaker (Mr. Dawson) a member of the Board of Control. Mr. Dawson also gave a brief description of the Elephant

Butte Dam, which was visited by the delegates, and which was built across the Rio Grande River in New Mexico to conserve the flood waters for irrigation purposes.

Eloquent Speaker from United States.

One of the most eloquent addresses of the Convention was delivered by Dr. F. B. Linfield, Director of the Montana Agricultural Experiment Station at Bozeman, Montana. Although Dr. Linfield's subject was sweet clover he took a few minutes of his time to discuss the international situation. Himself a Canadian by birth, it was a matter of particular gratification to him to be able to come to Canada on an occasion of this kind when the two countries were standing side by side for the principle of democracy. He believed Canadians would recognize, however, that the situation existing in the United States had to be treated with extreme patience in order that when the country did strike the full weight of its blow should not be mitigated by dissensions at home.

Address by Premier Martin.

Premier Martin paid the Convention the courtesy of making a special trip from Regina to say a few words of welcome to the delegates on the occasion of their first meeting in Saskatchewan. He, unfortunately, found it necessary to return East on the next train and was unable to follow personally the deliberations of the Association. Hon. Mr. Motherwell occupied the chair Wednesday and Thursday, when he was called East, and the Second Vice-President, G. R. Marnoch, presided over the concluding session.

Next Meeting at Nelson.

An invitation was received from the Nelson Board of Trade to make that city the next Convention centre, and this invitation was supported by Mayor Annable, of Nelson, who was present for the purpose of pressing it upon the Association. As it is the practice of the Association to meet year and

year about on opposite sides of the Rockies the invitation was accepted. The date of the 1918 Convention will be fixed later by the Executive committee.

The election of officers resulted as follows:

Hon. President, the Hon. Minister of the Interior, Dr. Roche, Ottawa; First Hon. Vice-President, the Hon. Minister of Agriculture, Duncan Marshall, Edmonton; Second Hon. Vice-President, the Hon. Minister of Agriculture, Mr. Motherwell, Regina; First Vice-President, Hon. Hewitt Bostock, Ducks, B. C.; Second Vice-President, G. R. Marnoch, President of the Board of Trade, Lethbridge.

Executive Committee: R. G. Williamson, Maple Creek, Sask.; Jas. L. Brown, Kamloops, B. C.; Jas. Johnstone, Nelson, B. C.; F. H. Peters, Calgary; A. S. Dawson, Calgary; W. E. Scott, Victoria, B. C.; F. H. Auld, Regina, Sask.; F. E. R. Wollaston, Vernon, B. C.

Robert J. C. Stead, of Calgary, was elected acting secretary.

Resolutions Adopted.

Among the resolutions adopted by the convention at its concluding session was one requesting the Minister of the Interior to investigate what steps are necessary and to inaugurate a definite policy towards reforestation of Cypress Hills forest reserve for the purpose of regulating the stream flow in the territory affected.

The Convention resolved to urge upon the Dominion government and the government of British Columbia, the importance of making appropriations and taking the necessary steps to continue without interruption the gauging of streams of water supply. It also indorsed the general principles of the resolutions passed at the recent better water convention at Lethbridge.

Another resolution directed the attention of the public health departments of British Columbia, Alberta and Saskatchewan to the supervision which will prevent pollution of waters in irrigation ditches.

HUSBAND THE FOOD SUPPLY

A Few Timely Suggestions on Livestock Food Conservation

Conserve the farm feeds. Saving them is next in importance to saving human food.

More corn, rye and barley will be used for human consumption this winter than ever before, in order that more wheat and wheat flour may be exported. This will cut down materially the available supply of feedingstuffs. A late growing season and, in some quarters, dried-up pastures, have conspired further to lessen the feed supply. Consequently farmers are certain to have difficulty in obtaining sufficient grain and roughage to winter a normal amount of livestock. To do so it will be necessary for them to husband the feed supply quite as carefully as the housewives of the country are conserving food supplies.

As it is too late for the farmer to adopt plans making for any material increase in the amount of feed available for the coming winter, his problem

is to make the best possible use of the supplies now in sight. This means avoiding wastes of feed.

Let there be clean mangers as well as clean plates.

Let the rats and mice do the starving.

Keep the livestock healthy and feed the animals in clean places, so that what is fed will not be wasted.

Careful attention to the arrangement of rations means feed economy as well as profit.

By making full use of the fall pasturage much of the harvested roughage can be kept for later use. Allowing the cattle, sheep and horses to clean up the odds and ends about the fence corners also saves feed that would otherwise be wasted. In order to have some early spring pasturage with which to piece out their winter roughage supply many farmers will find it advisable to sow rye.

IRRIGATION WATER FOR DOMESTIC USE

May Be Stored in Reservoir or Natural Depression

A valuable by-product of irrigation came to light at a convention recently held at Lethbridge, Alberta, to discuss ways and means of insuring ample supplies of pure water on the farm, says a bulletin of the Canadian Pacific. It was the opinion of the convention that the introduction of irrigation into a community has a very direct effect upon the volume of water available through wells and springs. The bulletin says: "Countries of light rainfall frequently have difficulties concerning domestic water supply, and it seems that irrigation solves not only the problem of moisture for the crops but also of supplying water for domestic purposes."

The practice of storing irrigation water for domestic use in cisterns or artificial ponds is no new one. In a country like Southern Alberta, which, not a desert, although it has a limited rainfall in average years (the average rainfall at Lethbridge is 17 inches per year) irrigation for the unlimited supply of good water for live stock is an important function. During the irrigation season (May to October) the farmers' water problems are at an end, although the solution may be so simple a matter as allowing water from a ditch to run into a depression in his pasture land.

The storing of water for winter use requires some expenditure of time and labor, but, in an irrigation district, is a comparatively simple matter. The water may be stored in a natural depression on the farm; a coulee or draw across which an earthen dam has been thrown; or it may be necessary to dig a reservoir. "Avoid soil of a very porous nature; be sure the reservoir is sufficiently deep that it will not freeze to the bottom; and have it so located that no drainage from contaminated sources will enter," says the bulletin, and adds, "The construction of such a reservoir presents no difficulties too great for the engineering skill of the average farmer."

The water from such a reservoir for household purposes, should be filtered. The Lethbridge convention discussed filtering rain water, and they suggest that the same plan could be applied equally to irrigation water. The plant consists of a sand and gravel filter and a concrete tank for storage purposes, and is recommended as affording a permanent solution of the domestic water question on farms where water is not easily obtained from underground sources.

The most interesting phase of the effect of irrigation on domestic water supply, however, is that to which reference has been made—the increase in water available from wells. According to F. H. Peters, of the Commission of Irrigation for the Dominion Government, one-sixth of the water turned into irrigation canals is lost through seepage, but this enormous loss of water contributes greatly to the water available from wells. He says: "As the irrigation development of the country con-

tinues the results will be still more noticeable. Eventually the Lethbridge-Northern project, the St. Mary's-Milk River project, and the Canadian Pacific-Lethbridge project will water 520,000 acres. This does not include the main Canadian Pacific project, which embraces about 3,000,000 acres. These projects will greatly influence the future supply of water for domestic purposes over these areas."

MILK RIVER PROJECT

By an engineering feat of the Reclamation Service the St. Mary River, which formerly belonged to Hudson Bay drainage, has become a contributor to the drainage of the Atlantic Ocean.

St. Mary River, a stream of large flow, rises in the snows and glaciers of the highest peaks of Glacier National Park. Its general course in United States is northward to the international boundary. In Canada it joined a number of other streams and finally emptied into Hudson Bay.

Today the St. Mary is diverted into a large canal twenty-eight miles long, and now flows into the North Fork of Milk River, a tributary of the Missouri. The Milk River, rising in the plains area of Northwestern Montana, flows northward into Canada, and then eastward for more than 100 miles drains dominion territory. It then turns abruptly southward across the boundary and, after flowing for many miles through a rich and fertile valley, joins the Missouri near Nashua, Mont. Draining no high mountains, its flow is erratic, uncertain, and entirely inadequate for the irrigation of the hundreds of thousands of acres of fertile lands through which it flowed in both countries. By combining the two rivers an enormous area of irrigable lands could be developed, and it was for this purpose the engineers of the Service worked out a plan, the successful completion of which is just announced.

For the reason that the lands in Canada could absorb the entire flow of both streams, an international treaty was entered into by which the Milk River in Canada was utilized as a carrier, and the combined flow of both streams equally divided between the two nations.

In the lower Milk River Valley important dams and reservoirs have been completed and a comprehensive canal system is now serving a considerable acreage. In its entirety the project will irrigate 220,000 acres, of which 29,900 are public lands to be opened to entry upon completion of necessary works.

The irrigable areas are served by the Great Northern Railway and surround the growing towns of Chinook, Harlem, Dodson, Malta, Saco, Hinsdale, and Glasgow.

The net investment of the Government to June 30, 1916, was about \$4,700,000.

New Cleveland Motor Tractor

The latest development in the motor tractor industry is the product of the Cleveland Motor Plow Company at Cleveland. This machine is a popular priced farm tractor designed along new lines and embodies a great many new ideas in farm tractor construction.

Rollin H. White, founder of the White Motor Car Company and a recognized authority on commercial vehicle construction, and C. A. Hawkins, one of the best known automobile men in the United States, worked for several years perfecting the new tractor and are now planning to place this machine on the market in every country in the world.

Two of the most interesting features of the Cleveland Tractor are the fact that it is steered by the power of the engine and that it is similar in design to the famous "British Tanks," using the steering wheel merely to indicate the direction that it is desired to take. Therefore, it is easy to operate, and has a spring suspension so designed as to make it flexible, to admit of the tracks following uneven ground, each side being counterbalanced by the other side on the cantilever principle.

It does the work of 14 horses, costs less than four, takes up less room and requires less care than one, and will do one hundred kinds of stationary work not possible with horses. It is 50 inches wide, 52 inches high, and 8 feet long.

It has effective traction for pulling. The outfit runs on a track, therefore will last longer, whether in sand, mud, plowed ground or on paved roads. One-third of engine power being sufficient to run the outfit, two-thirds is delivered to the drawbar.

The track on each side is 50 inches in length by 6 inches wide of the tread on the ground, making a total of 100 inches in length of tread and 600 square inches on the ground.

It has a sixteen horsepower motor and can develop enough power to work on any kind of road or grounds. The average amount of fuel consumed by this plow per acre is $1\frac{1}{2}$ gallons. It is claimed by the manufacturers that this 16-24 horse power tractor is sufficiently large for the farmer to buy who has a farm large enough to need a tractor at all and that its economy will prove the value of its efficiency.

This machine can operate on public roads, wooden floors, or plowed ground with equal facility. Plowing speed is $3\frac{1}{2}$ miles per hour, 8-12 acres per day. Will pull 3 14-inch plows under favorable conditions, and two under the very worst conditions.

The Cleveland Motor Plow Company, the manufacturers of this tractor, are making extra factory facilities for turning out this machine in large numbers. The fact that they are popular priced indicates the quantity demand for such types of machines.

SWEET CLOVER: A FERTILIZER

The most of our western lands have been produced under arid or semi-arid conditions. Consequently, most of them are low in organic matter (vegetable matter). These same soils are usually rich in mineral matter. In order to get the highest productivity out of such lands it is necessary to use manures which will supply vegetable matter

to the soil. There are two ways of accomplishing this object. One is to use stable manures. But no farm, aside from a few of the heavy stock-feeding farms, produces sufficient manure on its own area to supply the vegetable matter necessary for the farm. Consequently it is necessary to grow some crop occasionally which may be plowed under, thus supplying the vegetable matter.

Of the crops available for Colorado agriculture, sweet clover is one of the best for this purpose. It will give quicker returns than almost any other crop which may be grown to plow under as a fertilizer. Sweet clover will mellow up heavy adobe or clay lands to a greater extent than any other crop available to our agriculture. For a green manure crop, to get quick fertilizer value, we have no crop superior to sweet clover.

DEMANDS CARE OF LIVESTOCK

Save all the heifer calves and plan to raise more pigs, lambs, colts, calves and chickens next year than you did this year. Do you know the world is being depleted of its live stock?

Keep your pigs growing. They should weigh 200 pounds at six months of age and they are worth \$16.00 a hundred now. Ten good pigs are worth \$300.00.

Give your hogs all the alfalfa or clover they will eat winter and summer. Give them skim milk, whey, some grain, or anything else you have, but be sure to give them all they can eat.

Keep the calves growing. Give them some grain, separate from milk, and all the good hay they can eat. Veal is now worth sixteen cents a pound. A good veal is worth \$35.00.

Feed the lambs well. They are worth \$20.00 apiece and wool is worth from 50c to 70c a pound.

Feed the cows well. Keep them milking. You may dislike to see them eat so much, but please give them all they can eat all the time. The price of milk, butter and cheese is going out of sight. Butter fat may be worth \$1.00 a pound before long.

Feed and handle the mares so that you will save all the colts next spring. Good horses are worth \$75.00 a head more than they were a year ago. A good horse is worth \$300.00..

INTERESTING INSTALLATION

We show here a view of irrigation pumping installation on ranch of D. E. Low, Roswell, New Mexico. Pump is an "American" motor-driven, 24-



inch, deep well turbine centrifugal and maintains a delivery of 1,000 G. P. M. Pump discharges into concrete receiving tank which delivers water through underground concrete pipe to various places of discharge, dispensing with main irrigation ditches.

NEWS NOTES FROM IRRIGATION PROJECTS OF THE COUNTRY

CALIFORNIA

Farmers in the vicinity of Dixon, Solano county, are planning formation of an irrigation district comprising about 20,000 acres.

The Sutter Basin Company has been granted permission by the state water commission to use 45 second feet of water from the Sacramento river to be taken out near Grafton, Sutter county, by means of a centrifugal pump. This company plans to spend \$20,000 on a pumping plant and ditches to irrigate 7,984 acres of land in Sutter county.

A reservoir to cost about \$11,000, to store the water of three rivers and irrigate 300,000 acres of land in Madera county is to be built in the near future, according to a recent interview given by a member of the engineering firm of Quinton, Code & Hill, of Los Angeles. Work on the project will be done in the name of the Madera irrigation district, of which C. M. McCardell and J. G. Roberts are directors. It is to be a mutual concern. The land will be bonded under the state laws and sell bonds to cover the expense of the project. Water will be taken from the San Joaquin, Fresno and Chowchilla rivers and will irrigate practically the entire west end of Madera county. The dam will be about 9,000 feet long and 290 feet high.

Plans for the formation of an irrigation district in the Hayford valley of Trinity county are under way and a request has been sent to the state engineering department asking that an engineer be sent to the valley to determine the feasibility of the scheme. The proposed district embraces about 12,000 acres of exceedingly fertile land lying near the town of Hayford.

A. L. Dowler, of San Francisco, has purchased 1,800 acres of land lying along the Sacramento river near Ball's Ferry. The entire acreage lies under the system of the Anderson-Cottonwood irrigation district.

The promotion committee working upon the formation of the Woodbridge irrigating system has secured the signatures to 15,000 acres to be included in the new district. With the average now gained the bond on the land will amount to \$20 per acre, which will raise \$300,000. It is the present intention not to commence paying off the principal of this bond for 10 or 20 years, the exact time to be determined by the land owners later. The interest on this money will amount to \$1.20 per acre per annum and allowing \$7,500 per year for maintenance will make an additional tax of 50 cents per acre, that the farm-

ers will have to pay for the next 10 or 20 years. After that it will be a trifle more for a while until the principal is cut down. This will make the cheapest irrigation in the state. The land embraced in this new district lies near the town of Lodi in San Joaquin county.

The Baxter Creek Irrigation District in Lassen county, recently sold \$300,000 in bonds at \$97.20 to a San Francisco firm.

By a contract executed between Franklin K. Lane, secretary of the Interior, and Mr. Mark Rose, representing the Imperial Laguna Canal Company of Southern California, a tract of arid land comprising from 120,000 to 200,000 acres adjoining the Imperial valley, is to be irrigated by means of an all-American canal some 30 miles in length. The water is to be taken from the Laguna dam of the Yuma reclamation project on the Colorado river at Yuma, Arizona.

There is a prospect of the early completion of the Byron-Bethany irrigation system which will irrigate 15,000 acres of land. The project has been retarded, owing to the fact that it was controlled by a private company which could not condemn land for rights of way for the canal, but it has been reorganized, and as a public utility, has the rights of condemnation. The land is situated in Contra Costa county.

Work on the Paradise irrigation project in Butte county is progressing rapidly. Two miles of the main canal which is being constructed under a separate contract has been completed. W. H. Kraner, contractor for the distributing system, has a large ditching machine at work and several miles of trench for the pipes has been opened.

The Modesto irrigation district will hereafter manufacture all cement tile to be used in drainage ditches throughout the district. The cement tile factory of Irvin & Rinehart at Modesto, was recently purchased by the board of directors at a cost of \$4,280. Purchase of this plant was made at this time in anticipation of extensive work on drainage ditches which may be necessary in the near future in the lower acres of the district to the east and northeast of Modesto, which are in danger from the continually rising level of subwaters, due to irrigation in the higher areas.

According to statement made by Project Manager A. N. Burch, 12,000 acre feet of water may be saved annually if a major portion of the main canals of the Orland irrigation project are lined with concrete. At present some thirty miles are lined. Mr.

Burch wants this increased to 108 miles. The cost of maintaining unlined ditches is placed at \$123 per mile annually by Mr. Burch, whereas lined ditches cost but \$10 a mile a year to keep in condition. He declares that seepage and evaporation of water while in distribution throughout the unlined portion of the project amounts to thirty per cent of the total amount of water turned into the canal headgates.

With the intention of completing the project by April 1, 1918, work is being rushed on the \$285,000 West Side Irrigation District project in San Joaquin county.

Officials of the Long Valley Irrigation District recently made a trip to the Little Truckee river for the purpose of preparing for the survey of a 24-mile ditch to convey the waters of that stream to their project. The district which embraces 28,000 acres of land in Lassen county, has made application for permission to take 32,000 acre feet of water from the Little Truckee. The district has a natural storage basin in Long Valley which will impound 95,000 acre feet of water.

A 150-foot well is being drilled on the Christianson & Burmeister ranch near Willows. This water will be used for irrigating rice and will supplement or replace water now taken from the West Side Canal Company's ditch.

Construction soon is to be started on ten miles of main canal and laterals to irrigate the 9,000-acre ranch of P. B. Cross, near Willows.

The Railroad Commission has issued an order fixing the water rates to be charged by the Madera Canal & Irrigation Company operating in Madera county. The order of the commission authorizes the company to charge 50 cents per acre foot for water delivered from Oct. 1 to March 1; \$1.00 per acre foot for water delivered from March 1 to June 1, and \$1.25 per acre foot for water delivered from June 1 to October 1 of each year.

COLORADO

Suit has been filed in the district court asking for temporary injunction against the Consolidated Hillsborough Ditch Company, and asking that on final hearing this restraining order be made permanent. Mayor T. J. Norcross of Loveland, Zenos McCoy, M. J. Gard, W. B. Harris and Rev. G. Jos. La Juenesse are the plaintiffs. They sue the officials and agents of the company to prevent them from interfering in the ditch carrying certain water rights they are entitled to and

also to permit them to take the water from the ditch.

L. F. Williams, Pueblo contractor, has been awarded a contract for the construction of an irrigation dam to be built for the Nine Mile Irrigation Company, twenty-five miles south of La Junta. The dam is to be built on the Pickett Wire river to divide the water of that stream, turning the course into the Nine Mile canal.

This canal is one of the oldest in the state, having been built in 1860. The wearing away of the old dam, which is of primitive type, necessitated the building of the new structure, which will be 300 feet long. It is to be built of reinforced concrete, with a covering of tile which is being produced in New Mexico. Work on the dam will commence September 1.

TEXAS

An interesting injunction case was tried recently at Wharton in which were involved practically all of the canal men in Matagorda county, who sought an injunction against the Northern Irrigation Co. and the Markham Irrigation Co. to restrain them from using the water supplied them from Lane City. Judge Styles granted the injunction upon the grounds that the water after it got back into the channel of the river was public water and belonged to whoever could get it.

Extensive betterments are being planned by the La Feria Water Improvement District No. 3, Cameron county, La Feria, Tex., which recently voted an issuance of bonds to the amount of \$500,000. This is a municipal corporation organized to supply water for irrigating 25,000 acres. It will take over the present canal system (at a cost of \$90,000), representing an initial investment of more than \$300,000. It is the plan to expend \$410,000 to purchase a new pumping plant with a capacity of 110,000 gallons of water per minute, install reservoirs, laterals, canals, etc. George H. Byrnes, receiver, La Feria Mutual Canal Co., is in charge of the enterprise.

Articles of incorporation have been filed by the Texas Irr. Land Co. Headquarters of the company are located at Mercedes, Texas. Capital stock \$5,000. The incorporators are Lee B. James, of San Antonio; A. D. Dickinson, Jr., of Fort Worth; D. D. Merchant and W. H. Follett, of Minneapolis, Minn.

Articles of incorporation have been filed by the Wharton County Irrigation Company, Headquarters, El Campo, Texas. Capital stock, \$100,000. Incorporators: R. H. Hancock, El Campo; I. W. Jolly, and J. L. Henry, of Houston, Texas.

OREGON

With the sale of \$900,000 of the bonds of the Ochoco irrigation project in Crook county, comes the announcement that active work on the

permanent development of the big Central Oregon enterprise is to begin within two weeks and will be completed within eighteen months.

The bonds were sold to a syndicate composed of Stephens & Co., of San Diego, Los Angeles, San Francisco and Coronado, and Clark, Kendall & Co., of Portland. The price was 94.44 for 6 per cent securities with an average maturity of 17½ years.

The construction contract has been awarded to Twohy Brothers, who will construct the main dam across the Ochoco river and 15½ miles of the main canal.

The project comprises 22,000 acres, with Prineville as the center of the district. Seven thousand acres are now under water and 15,000 acres are being cultivated either under irrigation or dry farming methods.

Talent Irrigation District recently voted \$600,000 in bonds for construction of a water system from the Hyatt Prairie source of supply in Cascade mountains near Green Springs. The district embraces 8,500 acres of rich valley land nearly all under cultivation.

OREGON

Application for a permit to irrigate 2,700 acres of land in the lower Powder Valley, with the waters of West Eagle creek, was recently made to the state engineer by F. A. Phillips.

Plans for the Grants Pass irrigation district, covering 5,350 acres lying between Grants Pass and Gold Hill, have been received by the state engineer. It is proposed that the main canal supply the water also for the Gold Hill irrigation district.

By a vote of four to one, the state desert land board has decided to comply with the request of the Central Oregon Irrigation Company to ask the department of the interior for a five year extension of the contract between the state and the government for the reclamation of the lands contained in what is known as Oregon segregation list No. 6. This segregation is a part of the company's big project near Bend. The land is being reclaimed under the Carey Act, and if the state does not obtain an extension of its contract with the federal government the portion of the lands which were unclaimed at the time the contract expired would revert to the government as general public lands.

In a supplemental report on the Suttle Lake Irrigation district project in Jefferson county, State Engineer Lewis approves the plans to the extent of 15,000 acres. A former report made in 1915 approved the project for 13,000 acres. It is pointed out in the supplemental report that the shortage on the project in 1915, which was about 25 per cent, is in the face of an unusual condition and that such a water shortage would occur probably only at periods many years apart. The report also finds that the project will stand a charge of \$50 per acre.

UTAH

David S. Wegg, of Salt Lake, has filed an application with the state engineer for fifteen second feet of water from Fish creek, which drains portions of Piute and Sevier counties.

Atkins Hinton of Hurricane, has filed an application with the state engineer for the right to use one-half second-feet of water from Oak Canyon, to be used for irrigation purposes.

The Manderfield Irrigation Company, which waters 2,200 acres of land in Beaver county, has completed the improvements recommended by the local division of the federal irrigation service and the farmers on the project are receiving all the water they need for their crops this season. The improvement made it possible for the water supply to be conserved to such an extent that next year 1,000 additional acres may be placed under irrigation in that section of the state. The project has been losing a great amount of its water during the past few years and as the farmers had no way of measuring the flow of the streams or canals, too much water was used by those having prior water contracts.

WASHINGTON

Contract for the building of a dam across the lower part of Wilson creek has been let to H. J. Kimmel for \$6,240. The work consists of more than 1,300 cubic yards of earth and 250 cubic yards of concrete, and when completed will hold back flood waters in the spring and irrigate several hundred acres of now arid land. The land is mostly owned by T. C. Bennett of Wilson creek, and the dam will be built on his ranch.

The government dam at Union Gap, recently completed by the Indian Reclamation Service, cost \$144,264. It contains 7,271 cubic yards of concrete. This dam contains the headgate of the Wapato canal and is the first item of the permanent improvement which will lead to reclaiming an additional 70,000 acres on that project.

Voters at Attalia recently, by 25 to 15, decided to bond irrigation district No. 1 for \$125,000 to take over the water rights and irrigation facilities of the Attalia Land Company and also to repair and maintain the system. The project embraces land in the west end of Walla Walla county on the Snake river.

Seventy to 80,000 acres of land under the Yakima and Palouse projects, withdrawn by the reclamation service from entry, have been offered for lease by the government. The leases, which will extend to the end of the calendar year 1921, have been made on the basis of from 10 to 50 cents per acre. All lands under the Yakima project withdrawn and not brought under irrigation may be leased for four years.

ALFALFA DODDER COSTLY

By H. E. Vasey,
Colorado Agricultural College

Alfalfa fodder occupies an important place among the enemies of alfalfa and ought to be regarded as a serious pest. The dodder plant occupies a low position among the common green plants, in fact, is guilty of three serious offenses. First, it should be considered a loafer because it has lost the habit of making its own food; second, it is a robber because it takes from the alfalfa the juices which that plant needs for its own sustenance; and third, it is a criminal because it brings about the death of alfalfa plants on which it is growing.

Alfalfa growers find dodder appearing most frequently in the newly seeded fields because dodder seed is very commonly found as an impurity in seed alfalfa. Dodder germinates in the spring in about three or four weeks after the alfalfa has begun growth. It sends up slender, yellow thread like stems which sway back and forth with the wind until they come in contact with the stems of alfalfa. Then they attach themselves firmly by twining and producing tiny wart-like suckers at the contact. The dodder stems then break connections with the soil and live thereafter wholly upon the alfalfa, causing the plants to turn yellow and die.

The dodder plant is very peculiar in its make up. It has no leaves, no roots and no evident green pigment as green plants have. It does, however, possess true stems, flowers and seeds. The flowers are small and white in color. They are massed in dense clusters on the slender yellowish stems. About

mid-summer the flowers mature seed which falls to the ground and germinates the following spring.

The surest way to keep out dodder is to use clean seed. In infested fields the pest can be removed from small areas by cutting the infested plants and piling on dry straw and burning them on the spot where they grew. If a whole field is infested it will be best to plow it under, but it should be done before the seeds ripen. If seeds have been allowed to mature, the crop should be mowed, dried, and thoroughly burned. Cultivated crops should then be grown for two or three years before the soil is used again for alfalfa.

THE IMPLEMENT BLUE BOOK FREE

The Midland Publishing Company, St. Louis, Mo., has left over a few copies of the 1916 Implement Blue Book, one of which it offers to mail free of charge to any subscriber of this paper who will send 25 cents to pay the packing, postage, etc. The book has nearly 500 royal octavo pages and contains complete classified descriptive lists of all farming implements, tractors, tractor plows, vehicles, wagons and kindred goods made in the United States, with names and addresses of manufacturers.

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MISCELLANEOUS

Twelve thousand acres of land in the Shoshone project in Wyoming was opened to entry September 20. The land lies south of Frannie, extending to Mantua and Deaver on the south and southeast and is on the Burlington Railroad.

Secretary Lane announces the opening of a new townsite on August 29, on the Shoshone project in Northern Wyoming. It is located in the Fran-

nie Unit, which will be opened to entry in September, and which contains 41,000 acres of irrigable land. The townsite, which will be called Deaver, is on a branch of the C., B. & Q. Railway, between Billings, Mont., and Lovell, Wyo. On the opening day nearly 300 lots will be offered at public sale, the terms being all cash, or one-fifth cash and balance in four annual instalments, with 6 per cent interest. With the early opening of the Frannie Unit lands, Deaver should enjoy a good business.

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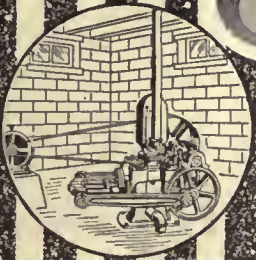
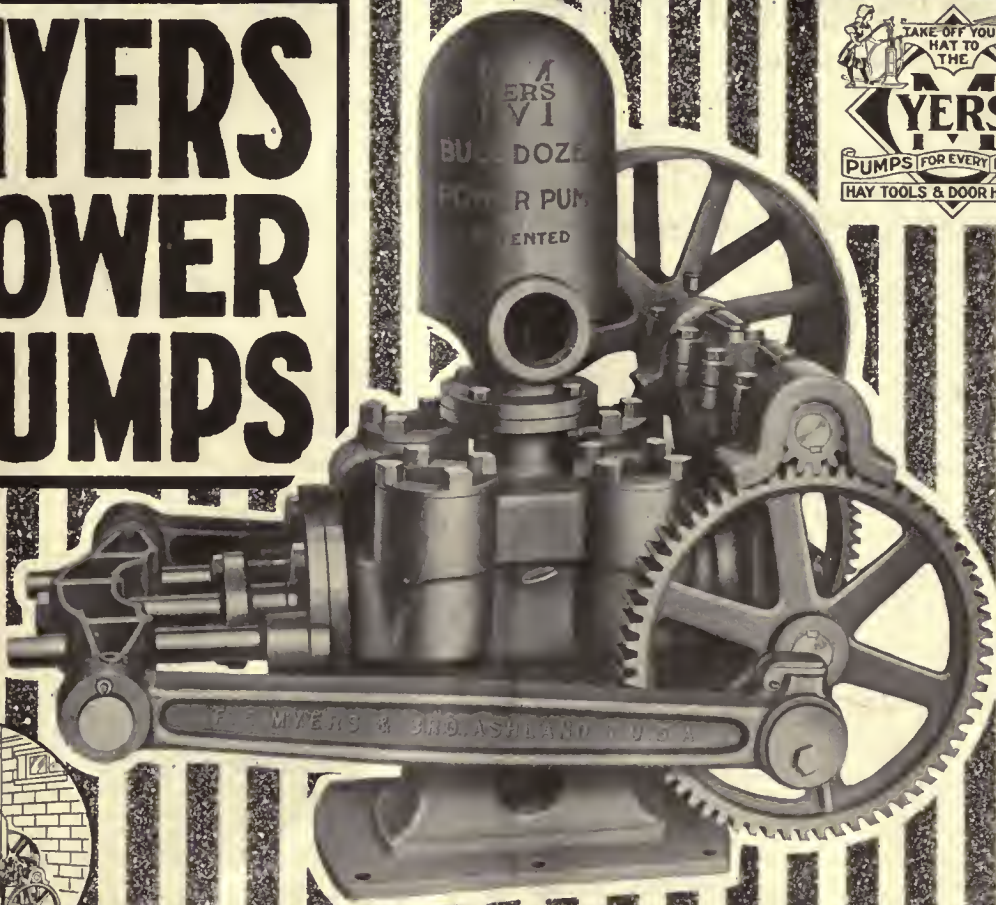
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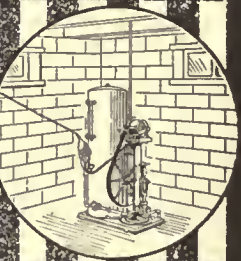
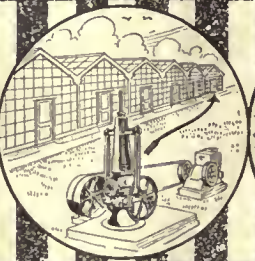
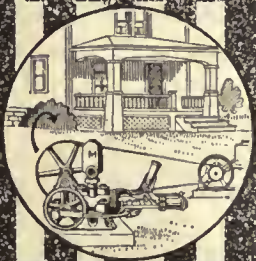
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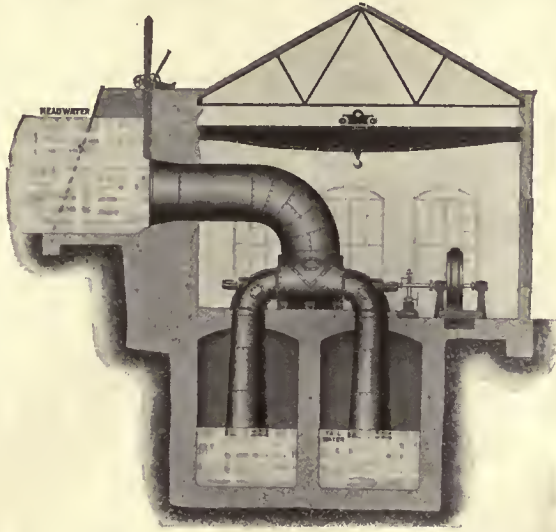
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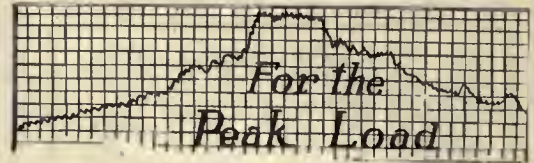


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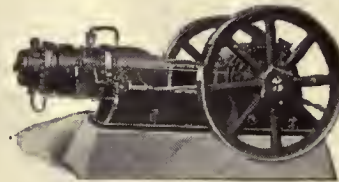
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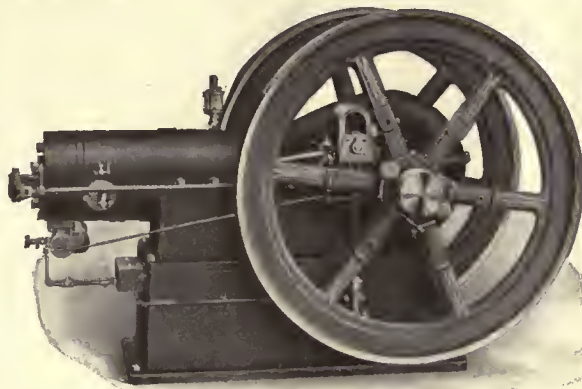
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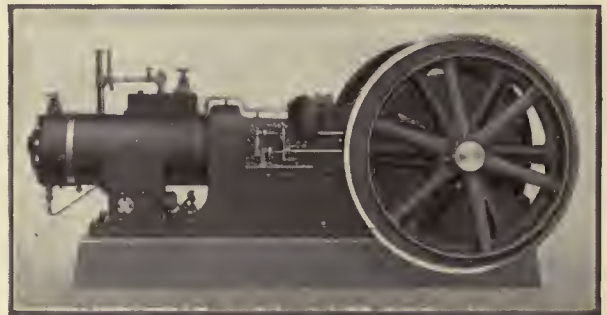
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THE IRRIGATION AGE

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THE IRRIGATION ERA

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THE IRRIGATOR

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Official organ Federation of Tree Growing Clubs of America. D. H. Anderson, Secretary.

The Executive Committee of the National Federation of Water Users' Association has taken action whereby THE IRRIGATION AGE is created the official organ of this vast organization, representing 1,000,000 persons on the government irrigation projects.

Railroads Deserve Earnest Support

It seems particularly inappropriate that the cry for government ownership of railroads should be raised at a time when transportation problems so vitally concern this nation. We are at war. Any unnecessary economic problems injected into the situation at this time tend to hinder or disorganize those strictly governmental functions that are so necessary to military preparations.

Those who understand the true situation must realize that there have been fundamental changes in our transportation affairs within the few months just past. Restrictions that had hitherto prohibited the railroads from co-operative policies and prevented their adoption of measures calculated to insure greater efficiency, have been removed by governmental injunction. Then came the long delayed co-ordination of facilities under conditions that make for economy in both shipments and operative expenses.

Upon the railroads has been thrown a mighty burden of responsibility. Mobilization of troops, in itself a huge task for nearly every railroad in the country, has proceeded at a time when transportation of crops and seasonable supplies has demanded the maximum use of rolling stock. In meeting these abnormal demands, without paralysis in any essential branch of the service, railroad organizations have merited commendation—not condemnation.

Nor should it be forgotten that the transportation interests were working under serious hardships

for many months prior to our declaration of war. Increasing operating expenses without proportionate advance in revenues had forced the roads to throttle their expansion in both construction and equipment. Prayers for higher freight rates, that additional revenues might meet the higher costs, were almost wholly ignored. Without relief from the dilemma, railroads were forced to curtail operations and restrict expenditures for upkeep.

Government ownership of transportation facilities should not be a debatable question when there is great stress in national activities, that seem not to require drastic action in this particular direction. It may be predicted that Secretary McAdoo as well as other cabinet members will recognize the menace in recurring agitations of this kind.

Future Control Presents Problems

Water users in the Uncompahgre district are getting below the surface in their inquiry as to what steps must be taken and what problems must be met if their organization should assume control of the project. These are healthy signs and point to an eventual determination of the whole problem along lines that shall be logical and conclusive.

Whatever controversies or disputes may arise in the discussion, water users should realize that engineering skill and knowledge can find a solution for questions of a technical nature, and that a broad administrative policy will overcome obstacles to maintenance and expansion. In neither of these

directions may the ordinary water user hope to obtain proficiency without long preparatory study and hard experience.

There is no especial benefit in trying to anticipate the difficulties that may be met as the years pass. Discussion of prospective expansion has a tendency, at this time, to confuse the issue and disorganize the general movement.

Controversies that arise should not lead the malignant opposition or personal criticism. When community development is at stake, difference in opinion should voice itself only in earnest argument.

Food Problems Stimulate Irrigation

There is every reason to be proud of the concrete reply given to the whole nation when it made its supplication at the altar of agriculture. Farmers have unanimously responded by an appreciable increase of acreage under cultivation this year. The results of this season's harvest is now known. Fears have been dispelled. The computation of the grain crop of America shows that a bumper harvest will be gathered.

The creation of the department for the conservation of food stuffs will prove of immense value to the farming interests in general and the country in particular. By guaranteeing the sale of the entire grain crop at a fixed value, the uncertainty of raising crops to be disposed of at fluctuating prices through unstable and spasmodic markets has been eliminated. If only for this act alone the department has demonstrated its *raison d'être*.

The outlook is very promising for further development. An elaboration of this program of the food conservation bureau might prove of inestimable value to both producers and consumers. If further guarantees were forthcoming as safeguards for the actual marketing of the enormous production of other staples during these abnormal times, the farmer would then be protected against unforeseen circumstances or glutted markets.

The crux of the situation can be readily recognized. The farmer should not be induced through a spirit of patriotism and duty to invest his time and services in the mainstays of life upon even a quasi speculative basis.

For several years there has been a steady influx to cities from the agricultural districts. Many who migrated with the expectation of stretching a dime into a dollar have experienced the difficulties of making both ends meet. They now look with eager and longing eyes at the success of their confreres who believed in agriculture and stayed with the farm.

Millions of acres of valuable farm lands are still yearning the combings of the plough. If ever

there was a real reason for the slogan "Back to the Land," it is in this present year of grace.

A review of the figures should convince any man with a slight knowledge of farming that it is one of the most lucrative industries. With the aid of the automobile the farmer can enjoy all the so-called privileges of townsmanship without any of its disadvantages. He can give an affirmative answer to a self-posed question.

"Why NOT back to the land."

From recent statistics we learn that in the southwestern states the acreage given over to the planting of winter wheat is fifteen per cent greater than that of last year. Obviously the reason lies in the belief that the demand will be of such character that the increase will be totally absorbed regardless of any conditions that may arise.

It is to irrigated lands that we must turn in the near future if we hope to solve the food problems and furnish supplies with absolute regularity. The climatic conditions in the irrigated districts are admirably adapted to the raising of crops in definite quantities. The encouragement of irrigating farming is a decisive step in the solution of a serious economic situation.

Experts Study Arizona Project

At the junction of the Salt and Colorado rivers there is an extensive tract of land eminently adaptable to irrigation. It is an exceedingly fertile territory with a semi-tropical climate. From the reports of analytical chemists it may be concluded that the constituents of the earth in this district are far superior to the alluvial deposits left on the soil when the river Nile recedes after the wet season. It may be assumed that with this belt irrigated under scientific conditions the crop value would be of great financial import.

The project is divided into three sections, the upper Gila being an extensive tract laying above the valley towards Florence. The middle Gila is at the junction of the two rivers and embraces the valley of the Casa Grande. The lower Gila lies below the junction of those rivers and comprises several valleys nearly 170 miles in extent.

There are many small areas that could be profitably reclaimed at a minimum expense as the Gila river is adjacent. The region is particularly adapted to the culture of long staple cotton.

This lower region of Arizona has been seriously neglected for some years and it would appear that conservative improvements offer good returns. During recent months it has attracted the favorable attention of irrigation engineers.

An irrigation and power plant engineer, Mr. B. W. James, of Los Angeles, has made a very ex-

haustive study of this territory and has presented a comprehensive review of the whole situation.

Behind that seductive American camouflage known as "conservation" there hides many a subtle Sophist whose barrage of specious argument defeats the popular will and frights a just and honest legislation. Once more has the slogan deceived our national congress. At its recent adjournment, water power legislation remained in the pigeon hole of political inexpediency. Conservation camouflage has triumphed; industrial efficiency was its victim?

How much longer may our representatives temporize over this problem. Is there to be no end of the wastage of water power. Is there no Moses to lead our congress from this Utopia of conservation?

America pulls upon her mighty stores of energy with lavish hand. Slowly, but with ever increasing volume, she draws her coal and oil from its bed of centuries. Proud in the possession of her marvelous fuels she throws away her substance and wastes her patrimony. Today she is prodigal—with the heritage of another generation.

In its attitude toward the natural water-powers within our boundaries, our government reminds one of the fabled dog in the manger. Yet, after the dog had the argument with the cow, the hay was supposed to remain intact. Not so with our conservation policy. Our government neither uses the water-

power nor can it retain the energy that goes to waste while it holds the argument. The dog had the least destructive form of churlishness.

It is high time that the American people undeceive themselves over that hideous nightmare wherein the rapacious power-octopus threw its giant talons around the waterways and waterfalls of this country and hurled defiance at all laws of equality, progress and human welfare. It was a dream—now let's rid ourselves of the after-scare.

Wasted water power is gone beyond recall. Hundreds of millions of horsepower are passing into oblivion because it is not harnessed. It is a gift from providence. We, the neglectful and improvident humans, quarrel over its possession. And while we argue and dispute over "conservation," those millions of energy-units slip from our grasp.

Search through all the avenues of commerce and industry, and each will yield its argument for utilization of our natural resources. Man lives only by curbing the wastefulness of nature and directing her activities into those channels that sustain his life. In our waterfalls nature challenges the ingenuity of man. In every second that passes she parades those energies that may be diverted to the use of man. And we continue to wrangle over the rights of the conquest.

In another column is presented an array of facts that cannot be contradicted even by the most pronounced exponent of conservation. They merit the careful study of every reader who cares aught for his own or the national welfare.

WATER POWER: THE NATION'S NEED

Man lives by curbing the Wastefulness of Nature and directing her energies into those channels that sustain life.

Development of our latent water powers is intimately associated with the solution of many of our greatest economic problems. Its effects may readily be traced through logical paths into the home life of every American citizen. It is a problem that confronts the nation as a whole and concerns the entire fabric of our industrial and social life.

The casual thinker invariably jumps to the conclusion that our water power, if developed by private enterprise, would aid only in the enrichment of the few individuals or corporations that might undertake the work. They fail to note that there are almost innumerable by-products from this development that, in themselves, would produce economies in production, transportation and even in the cost of living.

Through the agitations of ultra-conservationists there is a popular belief that any steps toward utilization of our water power by private enterprise must inevitably result in private and perpetual control. This, again, is a fallacy. It is generally recognized by those who have striven earnestly to find a solution of the problem that power sites should not be delivered from government jurisdiction. All plans

aim to the regulation of power production by a properly constituted federal tribune.

Bills that have been introduced in congress, but thus far have failed of passage, are directed toward some method by which the power might be utilized without loss of governmental control. There seems to be little difference in opinion among those who have studied the question and the only obstacle to legislation has been the lack of unanimity as to the provisions under which control may be exercised.

In addition to conserving vast quantities of coal and the labor to mine and handle it, the hydro-electric energy now wasting in our running waters should be utilized in manufacture of explosives, fertilizers, wood pulp and paper, electro-chemicals, copper, aluminum, etc.; operation of railroads by electricity; operation of irrigation pumping plants; operation of farm machinery; mining, and numberless other industrial applications.

Wood Pulp and Paper

Nature has grouped her natural resources in the far western states. Forests necessary to the manufacture of wood pulp and paper line the banks of

the falling water. Far more spruce, larch and hemlock timber is coming to maturity and wasting each year in our western forests, contiguous to also wasting water powers, than sufficient to produce, at cheapest cost, all the wood pulp and paper required by the newspapers of this country.

Of the 40,000,000 water horsepower contained within the Pacific Coast States being, 70 per cent of all the water power of the United States, but 2,500,000 horsepower, or 6 per cent, has thus far been developed.

The states of Oregon and Washington contain more available water power and more pulp wood than any other two states in the Union. Out of the 17,000,000 horsepower within the borders of these states, but 2 per cent in all has thus far been developed. The government forest reserves in these two states contain over 44,000,000,000 feet of timber suitable for the manufacture of wood pulp.

Water Power in Connection With Irrigation of Arid Lands

It is estimated that there are at least 10,000,000 acres of arid lands located in the far western states, lying above the reach of gravity water, that can only be reclaimed through water raised by pumps operated by the cheap hydroelectric power now latent and wasting in the various streams from which the water would be pumped. Thus the land, and at a lower level the water to irrigate it, and the power to raise the water to the land are often all assembled at one point. Given water, these lands will produce every fruit, vegetable and grain that is native to the temperate zone, and are capable of supporting a population of 2,000,000 people. If capital can be safeguarded, it is safe to say that hundreds of thousands of water horsepower will be utilized within the next ten years in connection with the reclamation of arid lands, and that in addition to what the government service will accomplish, hundreds of millions of dollars of private capital will be used for establishment of reclamation projects in connection with pumping plants.

Chemicals, Explosives and Metals

Vast quantities of hydroelectric energy are used in the manufacture of such chemicals as calcium carbide, caustic soda, bleaching powder, abrasives and electrodes; in electrolytic treatment of metals and alloys such as copper, zinc, aluminum, silicon and vanadium, and in production of acetone and atmospheric nitric acid used in making powder and explosives.

Over 200,000 homes are lighted in this country by acetylene gas, produced from calcium carbide, in the manufacture of which, at Niagara Falls, great quantities of hydroelectric energy are used. Because of our restrictive water power laws, the American Carbide Company could not increase its production in this country, and was forced to build a plant using 80,000 horsepower in Norway. The American Cyanamide Company, unable to develop water power in the United States, located a plant costing millions of dollars on the Canadian side at Niagara Falls, and several other manufacturers have located their plants in Canada and other countries within the past few years for the same reason.

Electrification of Railroads

Four hundred and fifty miles of the main line of the Chicago, Milwaukee & St. Paul Railroad,

between Harlowton, Mont., and Avery, Idaho, is now being successfully operated by electricity, and the remainder of the line to Seattle, a distance of 500 miles, or 950 miles in all, will be electrified as soon as installation can be effected.

The railroad will pay under the contract for power delivered over 450 miles of its road the sum of \$550,000 a year. It is paying now for coal to operate its steam trains over the same line approximately \$1,750,000. One-third of its equipment is used in hauling coal for their own use.

The Butte, Anaconda & Pacific Railroad are paying \$96,000 per year for electric energy to operate 80 miles of road, as against a former cost for coal of \$270,000.

It is almost certain that in the near future a majority of the railroads operating through the mountainous country of the far west, where hydroelectric power can be developed cheaply, will adopt electricity as motive power. Forty-eight thousand seven hundred miles of railroad are now being operated in the states of Washington, Oregon, California, Idaho, Montana, Wyoming, North Dakota, South Dakota, Utah, Arizona, Colorado and Nevada. It is estimated that 10,000 horsepower is needed to operate 100 miles of single track, and therefore it will require 4,870,000 horsepower to electrify all of the railroads of these states, or one-ninth of the total hydroelectric power possible to develop in the territory traversed by these railroads. A great portion of the trackage is over mountain divisions, and the use of electricity in place of coal will result in great economy of operation, and will make travel far more safe, comfortable and pleasant than at present, and it will go far toward curing the freight transportation problem through relieving car shortage, as the cars now used for carrying coal for railroad use can be used to carry freight.

Extension of Inland Waterways

A careful estimate shows that were locks installed in the power dams, over 4,000 miles of the upper reaches of these streams would be opened to navigation. The cost of these river improvements would be upwards of \$800,000,000, and, if accomplished by private capital for purpose of power production, would not cost the government a dollar except for the bare locks and removal of minor obstacles in those portions of the streams not connected with power development. If these river improvements were in one stream, it would be equivalent to creating a navigable waterway across the continent from New York to San Francisco. But in reality it means the extension of navigation for an aggregate of 4,000 miles in 35 rivers, traversing 20 states in such widely different sections of the country as Connecticut, Massachusetts, Pennsylvania, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Alabama, Georgia, Tennessee, Florida, Arkansas, Ohio, Kentucky, Missouri, Wisconsin, Minnesota, Washington and Idaho.

While it will take a long period of time to improve all the inland waterways which could be made navigable in connection with development of water powers, yet every 100 miles helps, and the construction of river power dams will be begun in many different sections of the country as soon as congress passes laws permitting safe investment of capital in water power developments.

The inland waterways of the warring countries of Europe are being used to their utmost limit, and hundreds of miles of new canals have been built since the war began. A new waterway 182 miles long, connecting the Oder and the Vistula rivers, have recently been opened to traffic, and 500-ton boats can go direct from Berlin to Warsaw and to the seaport of Dantzig.

Germany has thousands of miles of canals and rivers which have been made navigable, and are being used for carrying heavy freight, leaving the railroads free to be used for the rapid transportation of troops and food supplies. It is said that were it not for her freight carrying inland waterways the war would be over and Germany beaten because the rapid movement of her troops from one front to another would have been seriously impeded had the railroads been occupied with heavy freight shipments.

During the period of time when railroads were built and extended faster than traffic warranted, they naturally opposed river improvements, fearing water competition. But that time is passed forever. The railroads can no longer handle the traffic offered them and they welcome the passage of heavy freight by water. River steamers now act in most cases as feeders to railroads, gathering freight from points which railroads often do not reach and delivering it to them at terminals to be taken by rail to final destination. Transportation facilities are the very foundation of industrial prosperity, and the advantages of a complete and unified system of internal land and water transportation is of incalculable advantage of any country. Cheap transportation is as vital to industry and commerce as ammunition to an army.

With the increasing expense of government it is ever becoming more difficult to secure appropriations for river improvements. Why not avoid taxation by allowing private capital to perform the work in return for the privilege of being permitted to develop under public regulation the water powers now wasting in those streams?

Saving in Labor

During 1915, 442,000,000 tons of bituminous coal was mined, requiring the employment of 557,000 miners, from which it is apparent that the mining of coal is at the rate of 1.26 employes per annum per 1,000 tons of coal mined. Of the above quantity of coal mined, approximately 380,000,000 tons were shipped on cars and required the use of about 800,000 gondola cars and 27,000 locomotives, and in the way of labor in all of the branches of the railroad serving the movement of this freight there were required approximately 388,000 men; hence for every 1,000 tons of coal transported the services of 1.02 men were required to work a year.

This coal finally landed in the ash pile, and we find from statistics relating to employes in central steam stations that for every 1,000 tons of coal consumed there were required the services of half a man for one year. Therefore the total labor required for the consumption of every 1,000 tons of coal on the basis of one year's time is 2.78 men.

On the average, 1,000 tons of coal in the United States produce 125 horsepower for a year of time; 35,000,000 water horsepower developed and in commission would save the necessity of mining 280,000-

000 tons of coal per annum. As regards labor this vast tonnage requires for its production, transportation and consumption $280,000 \times 2.78$ men, or 778,000 laborers of one kind and another. The amount of labor required to operate this 35,000,000 water horsepower may be put conservatively at 40,000 men. Therefore the net saving in the way of labor alone by the installation of this water horsepower would be approximately 740,000 men available for other industries.

The above figures brought down to a statement that can be easily remembered amount to this: Every time 50 hydroelectric horsepower is developed and put in commission one laborer is permanently released for other uses.

The foregoing figures are of themselves of great moment with respect to the saving of labor, but there is still another tremendous conservation that has directly to do with the cost of food and to the cost of many other needs of life.

To transport 280,000,000 tons of coal there are required among other things 600,000 freight cars that cost about \$1,200,000,000 and 20,000 locomotives that cost about \$400,000,000 more, and if we add to the above figure other financial expenditures that are necessary so that the freight cars and the locomotives can do their work, we have as a result around \$1,920,000,000 of our railroad investment employed in the hauling of a commodity that could be dispensed with entirely and this great amount of equipment employed in the transportation of our farm products, certainly at a less cost than now obtains.

The spectacle of hauling 280,000,000 tons of coal (35,000,000 horsepower at 8 tons per year per horsepower) over our railroads each year when we could avoid so doing in a perfectly practical way is just as foolish as would be a proposal to make the railroads haul the salt water of the ocean on cars to interior points and there evaporate it for the salt it contains instead of using as we do the natural inland salt deposits.

Power in all its forms in the United States has been steadily going downward in cost for many years, yet in spite of this the average selling price of hydroelectric power is about \$10 per horsepower per annum less than the price of the same unit by steam.

Production of Foods

By increasing our annual use of fertilizer per acre of cultivated land from 28 pounds to 100 pounds, we can double our crops. How are we going to secure this enormous amount of fertilizer? We are now using 7,000,000 tons per annum and it would require an additional 18,000,000 tons to bring up the supply from 28 to 100 pounds per acre of cultivated land. We have abundant supplies of phosphate rock, both in the southern and in the far western states. We are doing our best to produce potash in absence of supplies from the natural potash beds of Germany, but where shall we secure our nitrogen? We are almost entirely dependent for our supplies upon Chile, but the Chilean nitrate beds show signs of exhaustion, and there are at present no available ships to transport the product.

It is here where the relation of water power to food production comes in. It is now possible,

(Continued on page 188)

DUTY OF WATER AND HOW TO DETERMINE IT

By E. C. McClellan, Irrigation Engineer, Los Angeles, California

The term of "Duty of Water," as used today in consideration of use of water in irrigation in the semi-arid sections of the country, is a phrase having practically no significance to the great majority of irrigators, because as used it bears no relation to the growth of plants. It is used to determine the quantity of water that can be placed into the land without totally destroying the plants grown there, and without regard for the ruining of the land being used for agricultural purposes. As a fact, methods used today ruin both land and plants, as is shown wherever crops have been grown in a section for any length of time.

To understand what irrigation should mean, there are a few fundamental matters that must be considered—and they are:

First—Plants have evolved to their present state of perfection through millions of years growth and development, during which time one of the greatest changes they have had to meet and adapt themselves to is a gradual decrease in the supply of water in the ground where they are growing.

That change has always been tending from a moist to a dryer state, and is so gradual that it is hardly perceptible during the few thousands years we have any record of. There is, however, a reasonably certain and fixed proportion or ratio between that moisture supply and the other elements stored in the ground and used by the plants for their structural growth and collection, manufacture and storage of those certain substances needed by man and animals for their growth.

Second—the plants have adapted themselves to that certain proportion or ratio, and are capable of securing the highest efficiency in growth and storage of food substances when under the influence or surroundings where such proportion exists.

Third—The elements needed by the plants are found in the air and in the ground. Those in the air are so regularly disposed or mixed together that the plant having evolved a method of securing them is not obliged to change in any particular at any part of the world. Those in the ground are very seldom exactly the same at all places; but after being placed in the ground—whether by nature or man, in fertilization—remain there, with the exception of those elements entering into the composition of water. Water is always moving, flowing down or away in the form of a liquid, or spreading through the ground, or rising up and escaping into the air as a vapor. It is necessary to constantly renew the water supply in the ground, to keep the proportion between it and the other elements required by the plants.

In a large section of the world this renewal is amply provided for by rain or snow fall.

Where the rain or snow fall is not sufficient to provide for the proper proportion or ratio between the moisture supply and the other elements needed, irrigation is needed, to provide the necessary

quantity of water, exactly as fertilization, so-called, is used to supply the deficiencies in other elements lacking. Irrigation is in fact just as much fertilization as the supplying of any other elements needed is fertilization.

In fertilizing, the constant aim is to supply the ground with just the necessary quantity of elements lacking, so the plants will return the greatest amount of food values for the quantity of fertilization used.

In irrigation, the aim should be to supply the ground with the quantity of water lacking, so the plants will return the greatest amount of food values for the quantity of water used.

Nature, having established a standard or ratio between all the elements entering into plant growth, the first aim should be to keep to that standard in water supply as well as other elements. Irrigation should mean bringing the water content in the ground up to that standard.

Plants having evolved from a wetter to a dryer moisture supply in the ground, have their intelligence turned in that direction, and their tendency is towards securing, manufacturing and storing a finer line of food substances under a less than standard moisture supply.

When the standard of moisture supply is raised by application of a greater quantity of water, the plant is driven back in its evolution. The result is shown by a greater structural growth, and the collection, manufacturing and storage of a less quantity of depreciated food substances.

This is due to the fact that, as the structural growth is mainly composed of the elements entering into the composition of water, the plant uses as much of it as it can, and provides a greater growth; but the presence of the excess water in the ground stops the combinations being formed there, that are taken up and stored by the plant, and known as proteids, or nitrogenous substances, and the excess water in the plant stops the manufacture of the sugars and starches, called carbo-hydrates; and these are the main food substances in the plants. In talk, water is called the life blood of the semi-arid sections; but in practice, its value is never considered. This is shown in all the reports of the United States, and the different states upon the effects of the use of water in irrigation. As illustration of this, I desire to comment upon a late bulletin issued by the University of California, No. 280, entitled "The Economical Irrigation of Alfalfa in Sacramento Valley." On the second page is given a summary of six years experiment at Davis, 1910-1915, inclusive, and also the precipitation for that period, as follows:

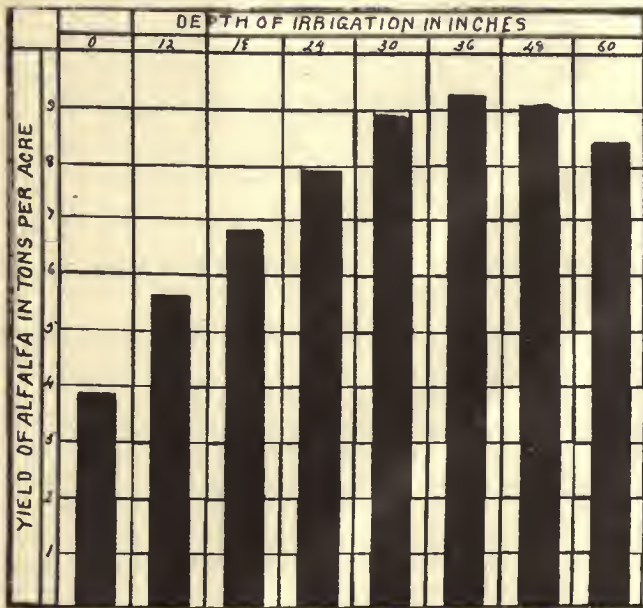
(Bulletin No. 280, California University)

Summary of alfalfa duty-of-water investigations at Davis, 1910-1915.

(First column gives number of irrigations; second column gives depth of each irrigation in inches; third column gives total depth of water applied).

		Yield in tons per acre							Average	Value hay per acre, \$7 ton.	Cost production per acre.	Profit per acre
		1910	1911	1912	1913	1914	1915					
2	....	3.85	5.94	5.25	2.75	2.89	2.35	3.88	\$27.16	\$8.73	\$18.43
3	6 12	4.78	7.52	6.51	4.31	5.83	4.84	5.63	39.41	15.37	24.04	
4	6 18	6.00	8.33	7.02	5.69	8.02	6.46	6.80	47.60	19.35	28.25	
4	6 24	6.00	8.33	8.32	6.89	9.96	7.96	7.92	55.44	23.22	32.22	
4	7½ 30	7.53	9.54	9.43	7.97	11.06	8.32	8.98	62.86	26.45	36.41	
4	9 36	7.53	9.33	9.38	8.22	12.48	8.63	9.27	64.89	27.96	36.93	
4	12 48	8.45	9.52	8.63	8.83	10.62	8.05	9.02	63.14	29.10	34.04	
4	15 60	...	...	10.17	7.25	10.70	5.55	8.42	58.94	29.44	29.50
Precipitation.....		11.90	23.18	9.46	8.74	28.70	20.05	17.00				

The following diagram was then shown, proving that "from two and one-half to three acre-feet of irrigation water per acre per year is sufficient for the growth of maximum economic yields of alfalfa on the medium loam soils of Sacramento Valley."



That statement is correct if the intention of the experiments was to determine the greatest amount of produce that can be raised from an acre of land; but the title of the bulletin presupposes that the intention of the experiments was the determination of the greatest amount of produce that can be raised by the use of a certain quantity of water applied in irrigation.

Suppose a man is the owner of the right of use of thirty acre-feet of water, and he wants to know how he can use that quantity to the best advantage in raising alfalfa. He reads the conclusions of the compiler of the bulletin, and naturally decides the best he can do is to use that water upon 10 acres of land, for the summary shows he will get 92.70 tons of hay, and have a profit of \$369.30, if he sells it at \$7.00 a ton.

But suppose he is not satisfied to follow the conclusions printed for his guidance, and studies out the summary for himself. The first thing he will find is that if he puts the water upon 30 acres of land, he will get 168.90 tons of hay, and have a profit of \$729.20. That is, he will almost double his crop returns and his profit.

Now, if he gets a little more inquisitive, he will look at the returns, cost and profit if he does not irrigate his land at all. He will see that if he should

give or sell his water right to some neighbor, the amount he would expend in raising the 169.90 tons of hay, will raise 204.90 tons, and his profit will be \$973.10.

Is not the 204.90 tons of hay, and profit of \$973.10 a great deal better than 92.70 tons of hay, and profit of \$369.30 he would get if he follows the advice given in the bulletin?

Now, suppose he goes into the financial end of the report, with the desire of finding out just how far he can have a thousand dollars go in raising alfalfa. A few minutes calculation will show the following:

Irrigating with 60 acre-inches per acre. Profit, \$1,002.00.

Irrigating with 48 acre-inches per acre. Profit, \$1,170.00.

Irrigating with 36 acre-inches per acre. Profit, \$1,321.00.

Irrigating with 30 acre-inches per acre. Profit, \$1,376.30.

Irrigating with 24 acre-inches per acre. Profit, \$1,387.70.

Irrigating with 18 acre-inches per acre. Profit, \$1,460.00.

Irrigating with 12 acre-inches per acre. Profit, \$1,564.00.

Without any irrigation at all. Profit, \$2,113.00.

There is a steady increase in crop returns and profit with decrease in quantity of water used per unit of land irrigated. The result is exactly the same as when a man places upon one acre of land the potash that should be spread over ten acres. The only difference is that in case of the water, it will leave the land in short time, and the land not be injured unless the practice is kept up; while it will take some time to get rid of the potash.

Examining the summary from standpoint of the plant, it will be seen that, after deducting the amount of hay raised per acre without irrigation, the balance shows that there is a very small increase in quantity per acre-foot of water used in irrigation up to 30 inches, and then a sharp decrease; but as a whole the returns per acre-foot of water are far less than those without irrigation. For instance; without irrigation, the returns are 2.74 tons per acre-foot of water; the first 12 inches irrigation only returns 1.75 tons; at 1½ acre-feet irrigation it is at rate of 1.95 tons per acre foot; at 2 and 2½ acre-feet, the returns were 2.02 and 2.04 tons per acre-foot; at 3 acre-feet it was only 1.80 tons per acre-foot, and at 5 acre-feet, it was 0.93 tons per acre-foot.

The conclusions to be derived from these figures are plain. Without irrigation, the standard of water supply needed by the alfalfa for its best growth and foods furnished, is reached closer than with irrigation. The plant responds to the increased water supply with a larger structural growth up to 30 inches. Then the water supply gets the best of the plant, and it rapidly degenerates. In the same stages the food producing powers become less with each increase of water supply. This is not shown in the report, but practical results in feeding stock with alfalfa hay raised under small and large quantities of water supplied are frequent. One ton of the hay raised without irrigation is worth in feeding value several tons raised with irrigation of five feet.

The greatest value of this Bulletin No. 280 is

in the actual money cost and profit columns. They furnish what every one wants to know, and is very valuable on that account.

The reason why this, and all other bulletins issued from time to time on irrigation have had no effect in deciding the duty-of-water for irrigation is that the commentator has always taken as a basis for determination of values the acre of land; and the land having no value the basis is a fictitious one. Given a million acres of land having no value, and a thousand acre-feet of water, and it is the returns secured from the use of the water that counts, and not the number of acres of land the water is used upon to secure those returns, and every bulletin ever issued shows that the returns from one acre of land upon which a large quantity of water is placed is never as great as the returns from several acres of land over which the same quantity of water has been placed.

It has also been vaguely considered that it cost more money to irrigate land with a large quantity of water than with a small quantity, but this has never been so well illustrated as in the table quoted here. That cost was found to be, cutting, raking, shocking and hauling, \$2.25 per ton; water

at \$1.70 per acre-foot; irrigation, \$0.50 per acre per irrigation.

There is a class of water users whose cost for irrigating is less in using a large quantity of water upon their lands than a smaller quantity. The method is to turn the water upon the land, and let it flow over it with little or no attention and for an indefinite period—sometimes turning it upon the land in the spring, and never turning it off until ready to harvest it. The result is a small quantity per acre, degenerated as shown in case of the 60-inch irrigation in the table, only far more so, and of very inferior food quality. Hay thus produced will barely keep an animal alive for a few winter months feeding time.

The same result is seen with other crops. In the older irrigated sections of the United States, wheat has degenerated until it cannot be used for flour; oats are nothing but husks; potatoes are so diseased and contain so little food substances they are hardly fit to eat. The yield per acre of land is greater than elsewhere, but the food value per acre is far less. It is structural growth and not stored food substances secured by such methods.

IRRIGATION AND OUR NATIONAL FOOD SUPPLY

By Percy A. Cupper, Assistant State Engineer, Salem, Oregon

War is the present business of the United States, and all the Nation's resources in men, money and supplies should be marshalled in a supreme effort to bring the struggle to a successful conclusion. Men are selected by draft; money is raised as needed; but for our food stuffs we must wait upon the slowly recurring seasons, with their attendant uncertainties.

The unusually dry season in Oregon and elsewhere, resulting in the partial or total failure of dry farm crops, brings forcefully to mind that irrigation on a sufficiently extensive scale will insure the Nation's food supply.

The world's need of American grown food-stuffs will not cease in 1918, 1919, nor perhaps in 1920, and during this period of excessive demand and unusually high prices the irrigation farmer has an opportunity never before offered to make the irrigated farm a success. In other words, irrigation is more nearly a national necessity, and conditions more nearly guarantee success to the individual irrigator, than ever before.

The federal government has wisely provided for the construction of roads in co-operation with the various states, and conditions are now such that equal wisdom would be shown in providing for the irrigation of additional land and the production of crops thereon.

While the sum which could be expended to advantage on irrigation at this time is a matter of conjecture, it is believed that \$75,000,000 allotted by the government for this purpose would be conservative. One-third of this amount could well be allotted for the completion of U. S. Reclamation Service projects, one-third in co-operation with the various states, and one-third in the irrigation and cultivation

of irrigated land which would not otherwise be in crop. Projects which might be classified as U. S. Reclamation Service projects would probably include some irrigation districts and Carey Act projects upon which certain co-operation could be secured, so that no hard and fast line could be drawn.

It is obvious that the states would not be in a position to promptly put up dollar for dollar with the federal government, on account of inadequate constitutional and statutory provisions. Therefore the co-operation in order to be effective, must include the acceptance by the federal government of irrigation district bonds and Carey Act liens. For example, the bonds of a feasible irrigation district project could be deposited with the federal government as security for the funds advanced for construction, the bonds drawing the same rate of interest the government is required to pay. The same is true of Carey Act contracts and liens. It would of course be necessary to reduce all projects to the basis of the irrigation district. That is to say, the co-operation could be only between land owners or prospective irrigators and the government. No Carey Act contracting company or private irrigation company could intervene.

In order to insure the hearty co-operation of the state and its continued interest in the success of the undertaking, it should be required to directly contribute, at least to the extent of the administrative expense of carrying the plans into effect within the state. No money should be available for expenditure in any state except for the completion of projects undertaken after the state has had an opportunity to furnish funds, excepting on a dollar for dollar basis in cash or the deposit of state bonds with the government. In all cases the land, water,

and works must be held for the cost of reclamation. This is not a new plan. It has been advocated before; in fact, the Oregon irrigation district law, like many others, makes provision for financing in this manner.

It is not enough that the irrigation works be constructed, but each acre for which the works are constructed should be made to produce a crop. Within the limits of practicability, every acre of land subject to irrigation in the United States should be commandeered, if necessary, and sown to wheat, making proper adjustment with the owner after taking into account the improvements to the land.

The question naturally arises: Could this be economically done? Would it not involve waste? Viewed from the conservative standpoint of anti-war conditions, it probably would not be considered economical. However, we must not overlook the high price of wheat, nor that the problem today is production, not purchase. Can it be accomplished in time to be of assistance to the nation during the war? The reply is another question: How long will the war last? It is not safe to rely upon predictions as to when the war will end. Who can say whether next season will bring forth rain or drouth, plenty or scarcity, food or famine?

Seventy-five million dollars is a large sum of money; not so large, however, as it seemed before this war, which has taught us to think in billions. It is in fact less than the amount now expended by our nation every four days for war expenses. If this money, expended in irrigation, will not do as much for our cause as it would expended in some other way, it should not be used for this purpose. However, it must be borne in mind that irrigation is not only a war time necessity, but will continue in peace times as a great national asset, the cost of which will be repaid to the government.

It would seem that all organizations and individuals interested in irrigation might well concentrate their efforts in the enactment of national legislation providing for irrigation development on a scale that will assist in meeting the needs of the nation for a greater food supply.

CORRESPONDENCE

Nisland, S. D., Sept. 8, 1917.

Irrigation Age, Chicago.

Dear Sirs: Enclosed is my check in the sum of \$2.00, for which please extend my subscription to March, 1919.

I like the work you are engaged in in behalf of the settlers on Government projects. We need all the help we can get "in the trenches somewhere out West." Hope you will meet with entire success in your new home, Salt Lake City, which is my "old home," by the way. Was there from 1887 to 1903, the period known as the "building boom." Hope you will also experience a boom. With best wishes,

A. M. ROSS.

Chicago, Sept. 24, 1917.

Editor Irrigation Age,

Chicago.

All the land in the U. S. now in cultivation is a little less than thirteen times as large as Illinois, leaving about 35 states untouched by plow or hoe.

We have more than two hundred million hydro-electric horsepower available for development in these United States.

Only about one-third our available lands are in cultivation. There are thousands of acres of unclaimed Government lands within 100 miles of Chicago.

Less than one-tenth of our waterpower is or ever has been developed.

We have one river alone in the U. S. with 1,000 miles of desert to the East of it, and 200 miles of desert to the West of it, extending a length of 2,200 miles through this desert, with eleven great tributaries coming down from the West and Northwest, with one great branch straight away from the North with eleven great tributaries of its own. To the East and Northeast are seven great branches flowing down to this mighty river, two of these boasting ten subtributaries each. This system drains the major part of five great states, and a minor part of two other states, and the whole of one great state, the Sharon Rose of this mighty cluster, the land of big endeavor, the sanitarium of the world, fair, sun-kissed Arizona.

And here within the network of this mighty river system, we find the tenth part of the waterpower of this mighty land of ours, a network draining 11 million square miles, or more than a billion acres of land, more than half of which is tillable, discharging more than an average of 60,000 cubic second feet of water into the sea every second of time throughout the year (132,000 maximum, 5,000 minimum flow), presenting a panoramic landscapery unlike anything else on earth, together with more than 5,000 dam-sites for reservoiring, diverting and controlling the waters that will bring under active and intensive cultivation more than 500 million acres of land richer than the inexhaustible prairies of dear old Illinois, incidentally furnishing 20 million hydro-electric horsepower to light, heat, mine, railway, manufacture, cultivate, telephone, telegraph, trolley line; in short, electrify more efficiently than has ever yet been done to any land or city however large or small, this gigantic empire, equivalent to ten states as large as Illinois. Incidentally, again, the hills and mountains, now barren as ash-heaps, surrounding these fertile valleys, as they then will be, will receive from these irrigated vales vapor sufficient to cover them over with richest verdure, thus recovering or reclaiming, without effort or pain to man, the whole of the Rocky Mountain desert region to gradually become the finest pasture lands for small cattle in all the world, and the Great American Desert shall be no more; its remotest and most barren parts shall blossom as the rose—a desert that divides and threatens our very existence today from a military standpoint.

The 5,000 dam-sites will give as many lakes, similar to that above Roosevelt dam near Phoenix, ranging from one to ten miles wide and from ten to fifty miles in length, an untold source of pleasure and profit to the people.

All this mighty work may be accomplished at a cost of about ½ million dollars for each dam, or 2½ billion dollars, and the work can be done in from five to seven years.

What a work for an Empire Builder. The figures are staggering, breath-taking! This Colorado Country, as above set forth, is the "Land-of-Mighty-Endeavor," and its reclamation, the answer of grateful mankind to its patient, mute, pathetic, appealing, age-long call for loving opportunity, is worthy the mighty genius of the mightiest nation God has yet raised up, our own beloved America.

You scoff my figures! Twenty million horsepower! That is more than there is in the U. S. More waterpower than there is developed in the world at the present time! Granted. What of it? Listen; with 2½ billion dollars, we have at least 1,000 engineers in America that will develop that amount of power in Grand Canyon and its 500 miles of upper and lower degradents, and any one of them capable of doing the work. Reservoiring the head-waters and sending it down in a steady average flow of, say, 30,000 cu. sec. ft., they will give you a Niagara every half mile of its length, every ounce of which will be utilized for power, and they will add to and not detract from its gigantic beauty, leaving its unspeakable grandeur unmarred and untouched.

If you would like a paper outline of each tributary, and its possibilities, and the wonderful merging into one Herculean task, as it moves from source and rolls onward to the sea, reclaiming an empire, fulfilling the age-long dream and prayer of the desert lands, making of a nation's weakness its mightiest bulwark of strength, the pleasure shall be mine.

JOHN M. HESS,

[Arrangements have been made with Mr. Hess for a series of descriptive articles on this subject.—Editor.]

WATER POWER THE NATION'S NEED

(Continued from page 183)

through the most wonderful and most useful of all modern discoveries, to obtain, with the aid of electric energy, unlimited supplies of fixed nitrogen from the atmosphere. Nitrogen plants using over one million hydroelectric horsepower are in operation in European countries, while the United States is not using a single horsepower for that purpose. This is a reproach to our intelligence and enterprise and is solely due to the failure of congress to enact laws under which capital may be secured for development of our now wasting water powers. Twelve million horsepower would be required to produce the necessary nitrogen. The cost of the fertilizer would be about \$580,000,000, and the resultant increase of crop value would exceed \$2,000,000,000.

In the twenty years preceding the war Germany had, through the use of fertilizer, increased the average of all her crops three and one-half times as much per acre as America. Germany, with 70 per cent of the population of the United States and cultivating but one-fourth the area, grows in normal

times 95 per cent of the food products which she consumes.

The use of fertilizer has a most intimate relation to the cost of living, which has increased in this country at a much more rapid rate than it has abroad.

The population of the world has doubled in the past sixty-five years, and with increase in numbers there is an increased per capita consumption of food.

The extraordinary increase in the cost of living in the United States has been principally in the cost of food products, while other items than foods have increased at only the general rate prevailing throughout the world. From 1900 to 1914 the cost of foods in the United States increased 35 per cent, and abroad only 15 per cent. The rapid increase in food cost in this country can only be checked by increased crop production, just as food prices were held down in Europe previous to the war through increase in yields per acre obtained without additional labor through the use of fertilizer. The countries of highest agricultural development are the largest consumer of fertilizers.

The problem of food shortage can only be solved through supplying the soil with atmospheric nitrogen fertilizer, and thus doubling the crops.

NEWS NOTES FROM IRRIGATION PROJECTS OF THE COUNTRY

CALIFORNIA

Application has been filed with the State Reclamation Board by Mrs. Annie M. Flaxon and Mrs. Hazel G. M. Montague to build a private irrigation system in Colusa County, covering an area of 1,458 acres.

Farmers in the district extending south from Oroville to the Central House and Honcut sections, have decided to organize a mutual irrigation district and will be allowed to sign for only the acreage they propose to irrigate. Construction of the irrigating canals will be commenced soon after signatures for the irrigation of 10,000 acres of land are obtained. The proposed canals will irrigate 60,000 acres in Butte county, south of Oroville, and it is estimated that 30,000 acres in Yuba county could also be served by the canal.

The Sutter Butte Canal Company has commenced work constructing an irrigation canal to supply water to a large acreage west of Biggs and Gridley. This canal will be used to convey water formerly carried in a section of Hamilton slough.

John W. McKeehan of Berkeley, has filed an application with the State Water Commission for permission to appropriate 675,000 acre-feet of the waters of the Calaveras river, by diversion and storage above Jenny Lind in Calaveras county. The application states that the works are to be turned over to one or more irrigation districts. A diversion dam of concrete, 13 feet high, 240 feet long on top and

bottom; waste way over and around dam, screw-stem headgates, costing \$15,000, are embraced in the proposed plans for the project. A storage reservoir covering about 5,000 acres, capacity approximately 450,000 acre-feet; a storage reservoir dam 200 feet in height, 1,600 feet long on top, height of dam above water when reservoir is full, 10 feet, are also included in the specifications. The estimated cost of the works is placed at \$2,500,000, and the area proposed to be irrigated at 150,000 acres in San Joaquin and Calaveras counties.

At the regular monthly meeting of the Happy Valley Irrigation District, held at Olinda, the irrigation system of the Happy Valley Land and Water Company was formally transferred to the district, which will pay \$3,000 a year rental with the privilege of purchasing the system any time within five years for \$89,570.

At a meeting held recently to consider the organization of an irrigation district between Pleasant Valley and the Sacramento county line, the following were named as members of a committee to obtain data and take such other steps as they deem necessary: Geo. Schiff, Sr., of Placerville; W. J. Goff, of Oak Hill; Jack Ray of El Dorado and C. M. Skinner of Rescue.

Eleven farmers of Bella Vista and Palo Cedro have held a meeting to attempt to form an irrigation district. It is proposed to take the unappropriated waters of Hatchet and Montgomery creeks through Cedar

Creek into North Cow Creek. The farmers concerned expect to irrigate 2,500 acres of land with the water so diverted, provided the State Water Commission will give the permission asked for.

Fearing that danger threatens their dam and weir on Kings river, the Alta irrigation district, a corporation, has filed an injunction suit against a series of John and Jane Does to prevent harm coming to the weir. Claim is made that unknown defendants have threatened to destroy the weir on Kings river or to divert the water of the river elsewhere and the district seeks to prevent both actions.

According to the complaint there is at present less than 300 cubic feet of water in the river and the district claims title to 1,000 cubic feet. In view of the low ebb of the stream any diversion at this time, the complaint says, would work hardship on the Alta district lands.

The district has about 250 miles of main ditch and lateral ditches through Kings, Fresno and Tulare counties.

COLORADO

After a delay of more than a year, trial of the suit involving the payment of the East Denver Municipal Irrigation District bonds and interest coupons has been begun before District Judge Butler. The trial probably will consume two months. The suit was brought by Prof. Wilbur F. Steele of Denver University, a landowner in the irrigation district, who is suing for himself and others. Henry

L. Doherty & Co., of New York, are the defendants. The suit is for the return of \$625,000 worth of bonds issued to Doherty & Co., or the payment of the face value of the bonds, plus interest, amounting altogether to about \$1,250,000. Professor Steele charges that after bonds aggregating \$625,000 had been turned over to Doherty & Co., and Fred Lucas, their engineer, changes were made in the plans for the irrigation project in the East Denver district and that these changes were not approved by a vote of the landowners, as provided by law.

D. V. Burrell, owning a 480-acre tract of land near Brandon, is having great success watering his farm by means of irrigation from wells. Chas. Suhl, in the same locality, is preparing an extensive acreage for irrigation by pumping water from wells and expects to have his land ready for irrigation next spring.

The Sun Land Company has purchased 640 acres of irrigated, unimproved land, two and one-half miles southeast of Hudson, from T. P. Stephens of Coronado, Cal., for \$48,000. Tractors are busy breaking ground and practically the entire acreage will be placed under cultivation.

IDAHO

The Robin Irrigation & Development Company has filed articles of incorporation with its chief place of business at Robin and a capital stock of \$50,000. The directors are M. J. McAughey, Heber T. Edwards, Albert Evans, A. M. Curtis and P. M. Larsen.

Directors of the Nampa & Meridian irrigation district have reached a decision to place on sale approximately 350 acres of lands now held as possible reservoir sites. The decision to release these lands for settlement and development by ranchers was reached at the monthly board meeting here Tuesday afternoon.

The largest tract to be offered for sale is that embraced in the old Greenhurst, or Nampa reservoir. It is located between Greenhurst and Collopy. Other lands held for reservoir purposes, and now to be offered for sale, are the Lake Ethel tract at the edge of Nampa, and what is known as the old electric light plant reservoir on the bench, just south of Boise. Appraisal of these lands will be made at once.

Property owners in the vicinity of Grandview recently voted unanimously to form the Snake River Irrigation District. Forty-five votes were cast. Three directors were elected, as follows: B. Querry for the first precinct; Samuel Sanderson for the second, and George Allen for the third.

Citizens representing the Orofino Commercial club are engaged in a survey for an irrigation ditch running from a point on Orofino creek, two miles east of that village, to the North Idaho sanitarium. It is the intention to build the ditch this fall

to have it ready for use next season in supplying water for irrigation purposes, covering nearly the entire village, as well as the fields and gardens of the state institution.

The State Land Board has formally approved the bonds given as security by the Owlsley Carey Land and Irrigation Company.

MONTANA

Holding that it will be the part of wisdom in the long run to irrigate the Greenfields bench, Secretary of the Interior F. K. Lane, in a letter to Senator Myers, gives the reasons why he must deny the petition of a number of settlers to be excluded from the Sun River project.

Secretary Lane states \$3,000,000 has been expended on the project and \$5,000,000 more will be expended to complete it. He admits that excellent dry land crops have been raised on the bench during the past few years, but cites the precipitation records to demonstrate the yields have been exceptional. He further points out that dry land grain farming will exhaust the fertility of the soil in 10 or 15 years, while irrigation will permit of diversified husbandry being practiced.

He takes the position that if a portion of the project is released large expenditures already made will be rendered useless, while the irrigation works on the contrary will add largely to the productivity of the land and the food supply of the country.

A contract has been awarded by the government to the Vulcan Iron Works Company of Denver, Colo., for furnishing lateral turnout gates for the Flathead Irrigation project in Montana. The contract price is \$5,607.

Thos. Dignan, an attorney of Glasgow, has purchased the Lohr ranch, a few miles west of that city. The ranch consists of 1,600 acres, and the consideration was \$50,000. The property is highly productive and is irrigated by water pumped from Milk River.

A great deal of discontent has been caused by the stoppage of work on the irrigation project being constructed by the government in Moiese valley, according to County Agriculturist John R. Campbell.

A mass meeting was held recently at which a formal protest was made, and an appeal issued to hasten the work at the earliest possible time. Last summer's drouth, according to the county agriculturist, has shown them the necessity for the quick completion of the irrigation work.

Last year's appropriation for the construction of ditches on the reservation was \$750,000, but in spite of this, the work has been delayed.

OREGON

The directors of the Grants Pass Irrigation district recently voted to call an election of land owners under the proposed district to vote upon a proposition to issue bonds

in the sum of \$290,000 for the construction of canals. The success of this plan will mean the irrigation of 8,000 acres now unused, and putting water on about 6,000 acres now tilled without irrigation.

The Lower Powder Irrigation Company is to rebuild at once the dam at Lower Powder River, which went out in the flood last spring. Engineer J. W. Bailey has been engaged to prepare plans and specifications of the new dam, which is to be of reinforced concrete construction. Work will be rushed to completion this fall.

The Desert Land Board has received advice from the Department of the Interior that a relinquishment filed by the Board on the Benham Falls irrigation project has been accepted. This project embraces 74,000 acres of land. Sometime ago the Board applied for an extension of time on contracts covering the project and later filed a relinquishment. There are three dispositions that may be made of the project i. e., It may be thrown open to homestead entry; it can be withdrawn from entry under the Cary Act or withdrawn under the United States Reclamation Act.

McCalister District Improvement Company, which will have headquarters in Deschutes county, has filed articles of incorporation. The object of the company is to operate an irrigation project for 1,263 acres. The incorporators are Ruth F. Caldwell, Guy McCallister and F. W. Levernz.

By a vote of more than 2 to 1, the ranchers in the vicinity of Medford recently voted in favor of establishing an irrigation district. This is the second election in two years. At the first election the required 60 per cent majority was missed by five votes. Ranchers now believe that the water is assured after a struggle of ten years. With irrigation Medford has been officially assured a beet sugar factory.

Petition for rehearing in the Squaw Creek Irrigation Company's case before the Public Service Commission has been filed by Vernon Forbes of Bend. The petition declares that the commission erred in holding that "the economic duty of water in this district is about two acre-feet per year." The petition further alleges that the commission erred in fixing a rate of 60 cents per acre-foot per year for water, declaring that such a price is prohibitive.

From Bend comes the announcement that the engineers of the Ochoco irrigation project in Crook County expect to have the enterprise completed within eighteen months.

Wm. Dalton, one of the most prominent stockmen in Southern Oregon, has purchased 22,000 acres of land northeast of Malin and adjacent to that town. The land lies very level and can be irrigated by

pumping water from the Klamath Reclamation Project ditch with a lift of 35 feet. The consideration involved was not made public.

UTAH

At the meeting of the Board of County Commissioners held early this month, the vote of the Springville Irrigation District was canvassed and a resolution passed creating the district and the following directors declared elected Orson Hutchinson, R. A. Deal and Moses Child.

A survey of the proposed Pahvant Irrigation District in Millard County, from Holden to Konosh, embracing about 56,000 acres, has been completed by C. J. Ullrich of the State Engineer's office. Water to the extent of .98,000 acre-feet has been allotted to the district and it is the intention of the promoters to purchase the greater part of the water from the Sevier Land and Water Company. The district has been organized under the new irrigation law. While the cost of the survey is being paid by the state, the new irrigation district will eventually reimburse the state for same.

Abandoning every proposition to rebuild the Mammoth dam, the stockholders of the Price River Irrigation Company, at a recent meeting voted in favor of permitting the state to foreclose on the property of the company to satisfy the indebtedness of \$80,000 to the state. It is contemplated by the farmers under this project to buy in the property at the foreclosure sale and then reorganize the company for continuance of its operation as an irrigation company. It is proposed to ask the state for a loan of \$30,000 with which to run a tunnel to take the place of the present flume which carried water to the reservoir, which was emptied when the dam went out in the spring flood. With the running of the tunnel the company will be able to furnish from its supply of 200 second feet of water sufficient to irrigate all of the land which was irrigated from the reservoir, up to about June 20, which will permit the growing and harvesting of the early grains and two cuttings of alfalfa.

A contract has just been let to Erick Rosenwall for the construction of a reinforced concrete dam at the old canal head for the sum of \$885, work to be completed Nov. 1. The Gunnison Irrigation Company has been to considerable expense of late repairing breaks and keeping up the dam, and at its last annual meeting the company decided to make permanent improvements of a substantial character, these including a concrete apron and side-wall protection at the reservoir besides a flume at the mouth of the tunnel. President Knighton states that due to the exceptionally large inflow of water it was necessary to defer this latter work for another season.

WASHINGTON

Owners of 2,000 acres lying above the Sunnyside canal, north of Prosser, at a recent election approved the proposal of the government to install a pumping plant there and put the land under irrigation. The estimated cost of the project is \$220,000 and an appropriation of \$250,000 is available for the work. It is expected that water will be delivered by next summer.

The extensive irrigation plant built at Wahluke by the now defunct DeLarm & Biehl corporation, which had a capitalization of \$5,000,000, was recently sold to Gale Matthews of Ephrata to satisfy a judgment of \$275. DeLarm & Biehl organized this big irrigation project in southern Grant county and sold stock amounting to thousands of dollars. The federal authorities investigated the scheme, the case got into the courts and when their project failed the owners disappeared. The project was then bought in by another party who had liens against the assets of the company, and now Mr. Matthews has been compelled, in order to get his money from his claim against the successor to DeLarm & Biehl, to buy the plant and other assets, which include a big steam pumping plant and other accessories.

MISCELLANEOUS

J. C. Dobbins, a real estate man of Phoenix, Ariz., has applied for the purchase of 71 sections of state land. About 45,000 acres will be placed under cultivation in the near future if his plans go through. The land in question lies south of Tucson in the Santa Cruz Valley.

Gary B. Brooks of Crowley, La., has purchased the Watertown Farm and Irrigation Company's plantation of some 1,300 acres lying just across the Mermentau river. The tract is improved with pumping plants, warehouses, etc. The purchase price was \$65,000.

Construction of the second largest irrigation system in New Mexico, which will rank second only to the Elephant Butte system, is in progress at East Las Vegas, N. M. The system will place under irrigation about 12,000 acres, including some of the most fertile lands in the state.

The Story Construction Company of San Francisco is building the system at an estimated cost of more than one-half million dollars. The work will be completed before March 1, next year.

The system will be supplied by a reservoir which will contain 22,000 acre-feet of water. The dam, which will impound this supply, will be 1,300 feet long and 90 feet high at its highest point. Its base will be 325 feet in width. The dam will have a concrete core which will be covered with dirt. The upper side will be rip-rapped to resist destructive action of the water.

The dam will cause the formation of a body of water three miles long with an average width of one mile. The lake when filled will contain enough water to supply the entire acreage under the system with water for one irrigation season.

The land, which will be irrigated, was given by Las Vegas in consideration of the building of the system and the consequent benefit the town will derive from the cultivation of the land. The land is not now for sale. It will not be placed on the market until the system is completed.

A1. Triteloff of Reno and Franktown, Nevada, has filed an application with the state engineer of Nevada, to take sixty-five second-feet of the flood waters of the Truckee river for irrigation purposes. The land to be irrigated lies in the Spanish Springs and Prosser Valleys, lying a short distance northeast of Reno. While no authorized statement has been made by Mr. Triteloff, it is understood that he and his associates have options upon several thousand acres of land in these valleys. It is proposed to take water from the Truckee river from a point above Verdi, and to carry it into the valleys by means of a high line ditch.

IRRIGATION BY MEANS OF CANVAS TUBE.

A very interesting contrivance was demonstrated last summer at the College farm. It consists of a long canvas tube in which are placed small brass gates, so placed that each gate will come opposite a row down which it is desired to discharge irrigation water. The tube is laid along the high part of the field, connected with the ditch at the upper end, the water runs through this tube without; the water is discharged through the gate openings in the amount desired by the irrigator, and the supply for each tube is controlled by opening the small gates in the tubes. The canvas tube decreases in size as it extends from the ditch so that the smaller head of water flowing at the extreme lower end is carried through a much smaller tube, and thereby a saving of material is obtained.

So far as the control of irrigation water is concerned this device is ideal. Further than that it is easily changed from place to place by allowing the water to run out of it and then dragging it along the ground. The only thing that will have to be watched is that it is thoroughly cleaned when irrigation ceases, because the canvas will of course in time rot, and the same care must be given a tube of this kind as is given to the ordinary canvas dam in order to preserve the same.

E. B. House,

Colorado Agricultural College,
Fort Collins, Colo.

If you want to keep in touch with all sides of the Reclamation Problem send \$1.00 for one year's subscription to the Irrigation Age, 30 North Dearborn Street, Chicago.

**Statement of the Ownership, Management, Circulation, Etc.,
Required by the Act of Congress of August 24, 1912,**

Of The Irrigation Age, published monthly at Chicago, Ill., for October, 1917.
State of Illinois, County of Cook—ss.

Before me, a notary public in and for the state and county aforesaid, personally appeared D. H. Anderson, who, having been duly sworn according to law, deposes and says that he is the publisher of the Irrigation Age and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Poetal Laws and regulations, printed on the reverse of this form, to-wit:

1. That the names and addressee of the publisher, editor, managing editor, and business managers are:

Publisher—D. H. Anderson, 30 N. Dearborn St., Chicago, Ill.

Editor—D. H. Anderson, 30 N. Dearborn St., Chicago, Ill.

Managing Editor—D. H. Anderson, 30 N. Dearborn St., Chicago, Ill.

Business Manager—E. Donnelly, 30 N. Dearborn St., Chicago, Ill.

2. That the owners are: (Give namee and addrese of individual owners, or, if a corporation, give lte name and the names and addressee of etockholdere ownling or holding 1 per cent or more of the total amount of atock.

D. H. Anderson, 30 N. Dearborn St., Chicago, Ill.

3. That the known bondholders, mortgagees, and other security holdere ownling or holding 1 per cent or more of total amount of bonds, mortgages, or other securitie are: (If there are none, so etate.)

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D. H. ANDERSON,
(Signature of editor, publisher, or owner.)

Sworn to and eubscribed before me thie 3rd day of October, 1917.

[SEAL.]

MICHAEL J. O'MALLEY,
(My commiselon expires, March 8, 1920.)

DEMAND FOR TRACTORS INCREASING

Although the number of horses and mules in this country is continually increasing, the demand for power is increasing much more rapidly. Men are learning to do more and more work by mechanical power.

Small gasoline engines are being made use of very largely, but a large portion of the power needed must be in the form of draft. Hence it is necessary to use the tractor. This very easily accounts for the sale of such a vast number of tractors and the ever increasing demand for this farm machine. It is hard to understand how anyone can say the tractor is a fad and back his belief by any sound reasoning.

The tractor is not a fad, but a necessity without which, in the present crisis, this and every other warring nation would be in a sorry plight. It would be impossible to maintain the army at the front without tractors to convey food and to help with the farming operations.

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HOW TO REPAIR AND MAINTAIN THE ROADS.

The making of good roads is one of the most important duties of the American people and their prompt repair and careful maintenance is essential. There is probably no subject in which the progressive farmer is more deeply interested than that of having roads connecting him with his markets over which he may be able to haul the greatest possible load. Good roads, like all other good things, are too expensive to build and of too much value to be neglected.

The Office of Public Roads of the Department of Agriculture has published a bulletin on "Repair and Maintenance of Highways."

This bulletin does not treat the subject of road building, but takes up the repair and care of roads after they are built. All classes of roads, from the natural earth road to the macadam roads with bituminous surfacing, have received attention. The action of automobiles on road surfaces is explained. The systems of road management in Massachusetts, New York, England, and France are given, with tables of costs.

The writer concludes that on account of the use of heavier vehicles and motor trucks the tendency of road building is toward a heavier and more substantial foundation and a consequent reduction of the cost of maintenance.

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Water is taken from the Portage River, about the center of one side of the farm, and pumped through a system of underground cast iron piping leading to risers which connect with the overhead galvanized distributing pipes, which are fitted with spray nozzles spaced three feet apart throughout the system. Overhead piping is seven feet above ground, lines are 52 feet apart and are provided with means for turning so that they may spray in either direction.

Each lateral pipe line is provided with a valve so that any part of the system may be turned on

or off. The ground is irrigated in sections about one-third at a time. About 60 gallons of water per minute are required for each acre, about four hours are required to saturate each 22-acre tract, and about 12 hours to irrigate the entire 65 acres.

Views of the interior and exterior of the pump house and a small part of the overhead system are shown in accompanying illustrations.

The pump supplying this system is an "American" 8-inch, Type DTMD, horizontal, single stage, double suction, split shell turbine centrifugal, designed for a normal delivery of 1050 G.P.M. against 176 feet total head. It is driven by a 75 H. P., 3-phase, 60-cycle, 220-volt, slip ring, General Electric motor operating at 1740 R.P.M.

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